OPTIONS™ by IBM®

3D PCMCIA Sound Card

Installation and User's Guide

3D PCMCIA
Sound Card

Installation and User's Guide

Product Warranties and Notices: Before using this information and the product it supports, be sure to read the general information contained on page 77.

First Edition (July 1995)

The following paragraph does not apply to the United Kingdom or any country where such provisions are inconsistent with local law: INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

Requests for technical information about IBM products should be made to your IBM Authorized Dealer or your IBM Marketing Representative.

© Copyright 1995

Contents

Safety Information vi

Your 3D PCMCIA Sound Card 1
About Your Sound Card 2
  Audio Support Software 2
  MIDI 2
System Requirements 2
Additional Audio and Hardware Components 3

Installing the Sound Card in Windows 5
Installing the Software 5
  Installation Notes 6
Removing the Software 8

Installing the Sound Card in DOS 9
Installing the Software 9
  Installation Notes 10
Removing the Software 10

Installing the Hardware 11
  Connecting Audio and Other Equipment 12
Installation Is Complete 13

Using Your Sound Card in Windows 14
Audio Functions 14
Audio Mixer Panel 15
Recorder 17
Using a Microphone 19
MIDI Introduction 20
  Playing MIDI Files 20
  Understanding the MIDI Mapper 21
Playing Games in the Windows DOS Box 22
  Port Address, Interrupt Line and DMA Channel . . . 22
  Playing Games in the Windows DOS Box 23
  Adjusting the Volume 23
  Improving DOS Games Performance 23
  Trouble-shooting Problems with DOS Games 24
  Disabling DOS Games Audio 24
Optimizing Your Use of the Sound Card 24
  EMM386.EXE 24
  Other Memory Managers 25

- Games Requiring More Than 1024K of EMS or XMS Memory 25
- Improving Recording and Playback Quality 26
- Selecting an Audio Mode 27
- Audio Storage 27

Power Management Support 29
- Hot-plugging 29
- APM and Card and Socket Services 29

Using Your Sound Card in DOS 31

Hot-plugging in DOS 31

Games Support 31

Setting the Port Address, IRQ and DMA Channel 32
- Port Address 33
- Interrupt Request Lines (IRQs) 33
- DMA Channel 34
- Compatibility 34

Setting up DOS Games 34
- Games Compatibility 36
- Other Considerations 36

Adjusting the Volume 37

Optimizing Your Use of the Sound Card 37
- Freeing Up Memory for DOS Games 37

About Card and Socket Services 44

Interrupt Request Lines (IRQs) 44

I/O Port Addresses 45

Card and Socket Services 45
- High Memory Allocation 46

Configuring Specific Versions of Card and Socket Services 47
- IBM EZPLAY 48
- Phoenix CardManager (PCM) 48
- SystemSoft CardSoft 48
- Award Cardware 49

Operating Without Card and Socket Services 49
- MWPCMS.EXE 50

Help and Service Information 52

Step 1: Troubleshooting 52

Step 2: Preparing for the Call 53

Step 3: Placing the Call to IBM 53

Appendix A. The Audio Attachment Module 54

Attaching the AAM . . . 54
Game Port Address . . . 55
MIDI Port Option . . . 56
  Playing a MIDI Song via the MIDI Port . . . 56
  Recording a MIDI Song via the MIDI Port . . . 56

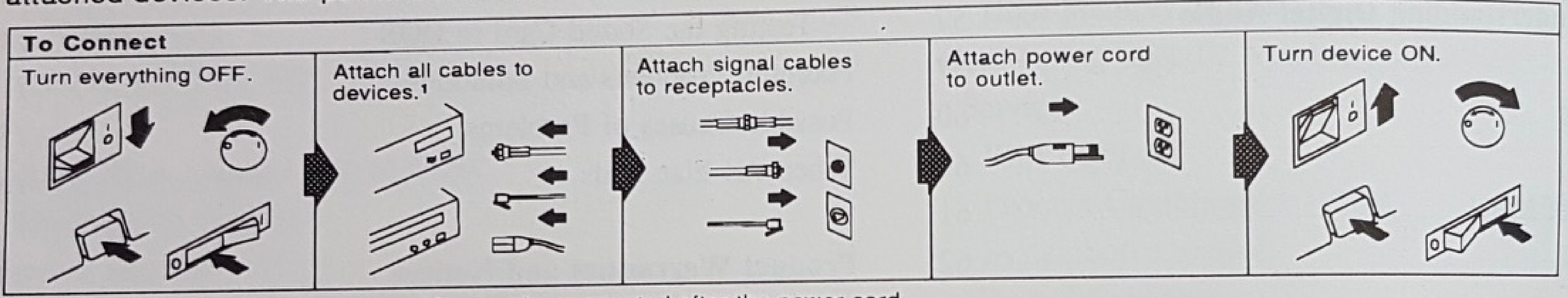
Appendix B. Understanding Digital Audio . . . 57
Digital Audio . . . 57
Waveform Audio . . . 60
MIDI Audio . . . 60
  A Definition of MIDI . . . 61
  General MIDI . . . 62
MIDI Support . . . 63
  MIDI Controls . . . 63
  General MIDI Melodic Instrument Patches . . . 64
  General MIDI Percussion Note Mapping (Channels 10 and 16) . . . 68
  MIDI Synthesizer . . . 69

Appendix C. Testing and Problem Determination . . . 70
Problem Determination . . . 70
  Testing the Sound Card in DOS . . . 70
Potential Problems and Solutions . . . 71
Possible Causes of Problems . . . 75
When All Else Fails . . . 76

Product Warranties and Notices . . . 77
Notices . . . 79
Trademarks . . . 80
Electronic Emission Notice . . . 80

Safety Information

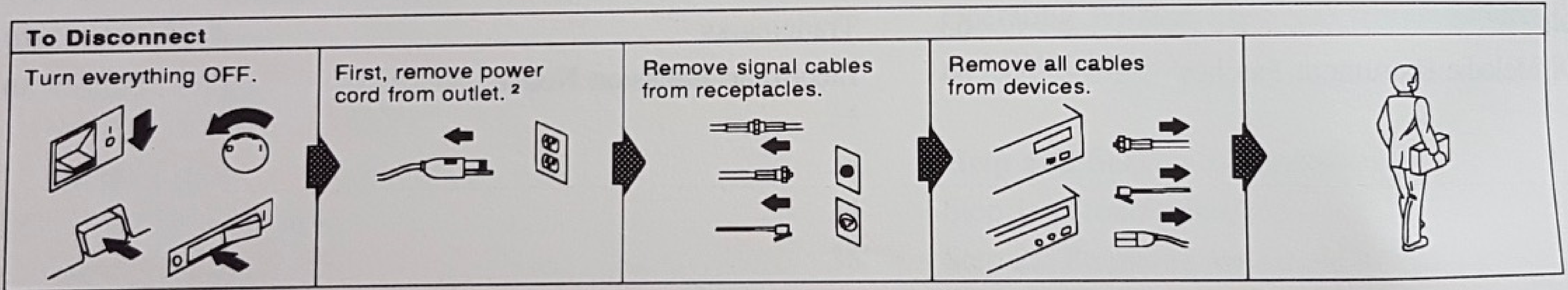
DANGER:
Electrical current from power, telephone, and communication cables is hazardous. To avoid shock hazard, connect and disconnect cables as shown below when installing, moving or opening the covers of this product or attached devices. The power cord must be used with a properly grounded outlet.



To Connect

1. Turn everything OFF.
2. Attach all cables to devices.[1]
3. Attach signal cables to receptacles.
4. Attach power cord to outlet.
5. Turn device ON.

[1] In the U.K., by law, the telephone cable must be connected after the power cord.



To Disconnect

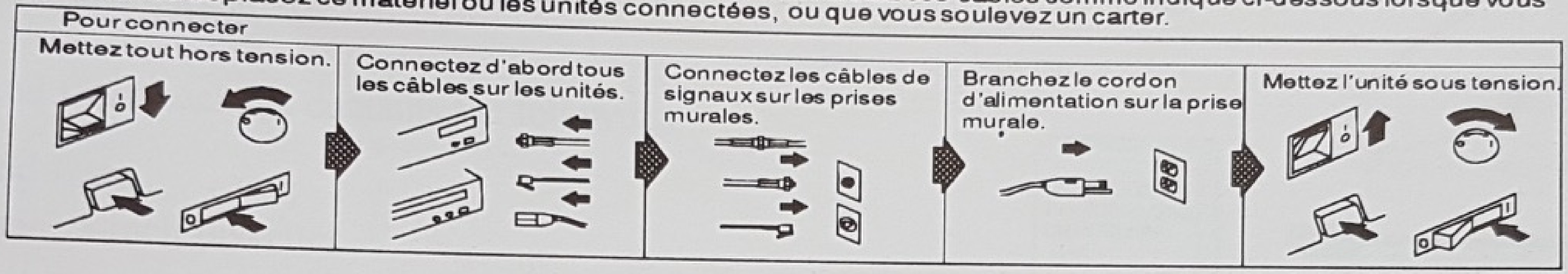
1. Turn everything OFF.
2. First, remove power cord from outlet.[2]
3. Remove signal cables from receptacles.
4. Remove all cables from devices.

[2] In the U.K., by law, the power cord must be disconnected after the telephone line cable.

DANGER:

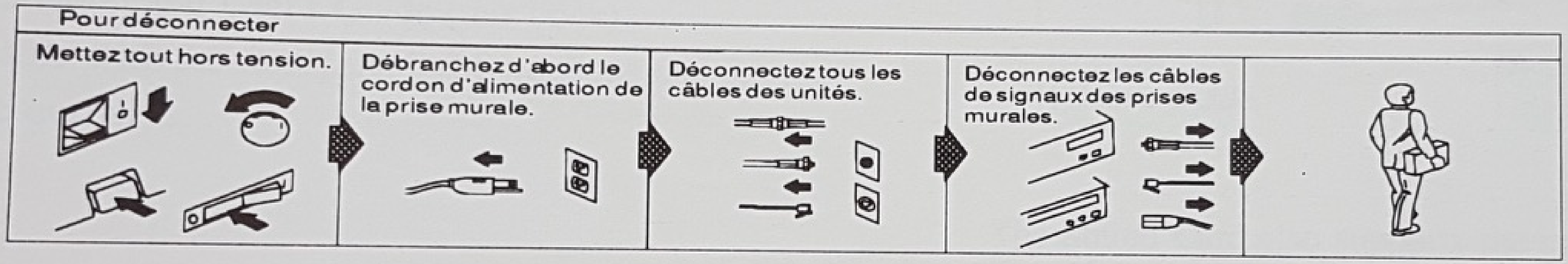
Le courant électrique provenant des câbles d'alimentation, téléphoniques et de transmission peut présenter un danger. Pour éviter tout risque de choc électrique, connectez et déconnectez ces câbles comme indiqué ci-dessous lorsque vous installez ou déplacez ce matériel ou les unités connectées, ou que vous soulevez un carter.

Pour connecter



1. Mettez tout hors tension.
2. Connectez d'abord tous les câbles sur les unités.
3. Connectez les câbles de signaux sur les prises murales.
4. Branchez le cordon d'alimentation sur la prise murale.
5. Mettez l'unité sous tension.

Pour déconnecter



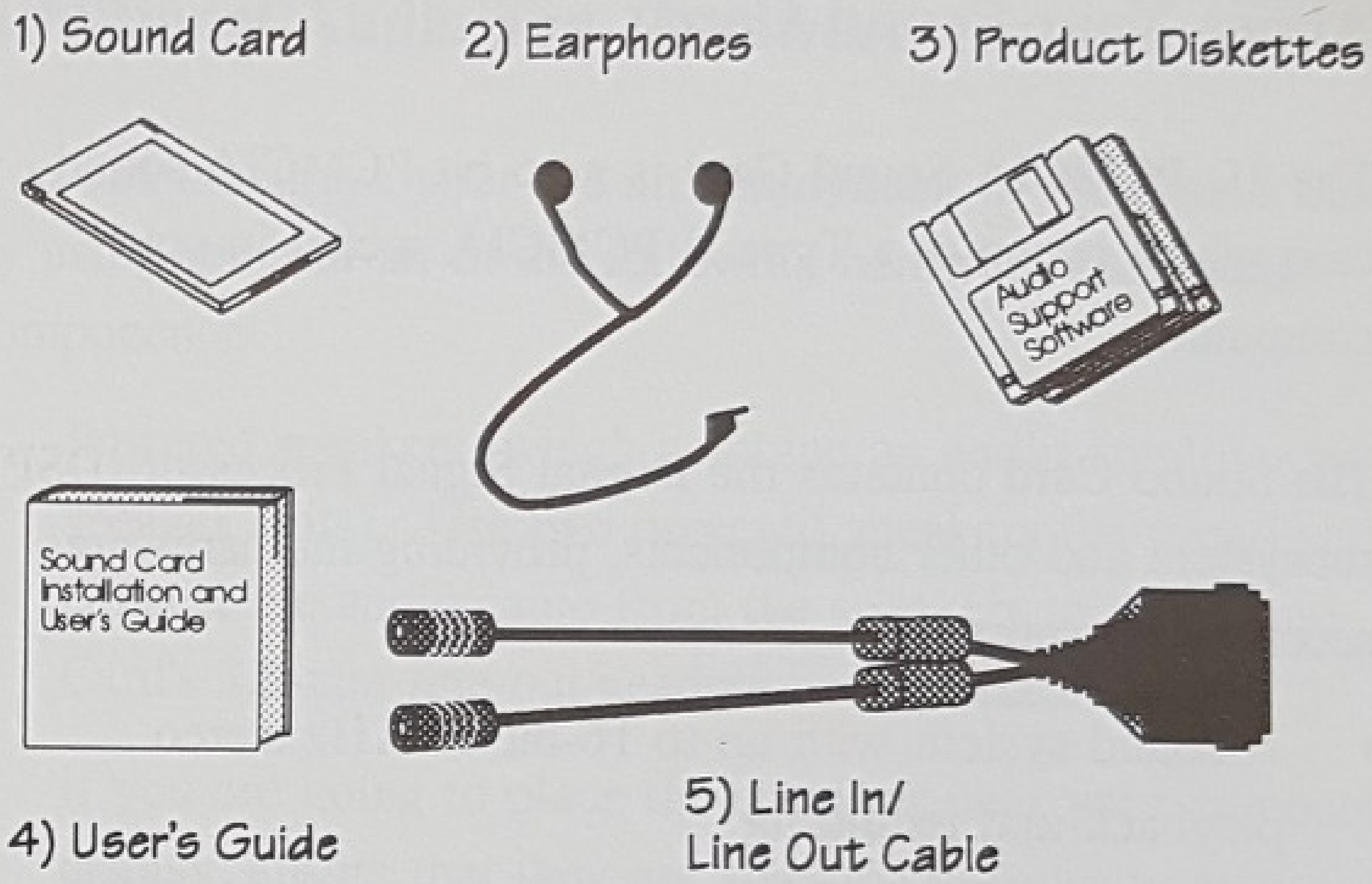
1. Mettez tout hors tension.
2. Débranchez d'abord le cordon d'alimentation de la prise murale.
3. Déconnectez tous les câbles des unités.
4. Déconnectez les câbles de signaux des prises murales.

Your 3D PCMCIA Sound Card

Thank you for purchasing the IBM* 3D PCMCIA Sound Card. We hope that it will be a valuable component of your computer system.

The Sound Card package contains the following:

- Sound Card
- Three 3.5-inch diskettes
- Installation and User's Guide (this book)
- A cable with 3.5-mm Line-in/Microphone and 3.5 mm Line-out jacks.



The Sound Card also supports the use of the Audio Attachment Module, which provides a Game/MIDI Port and a built-in microphone. This option is available from your point of purchase as part number 08H3842. For additional information, refer to Appendix A, "The Audio Attachment Module" on page 54.

If any item is missing or damaged, please notify your place of purchase.

About Your Sound Card

The 3D PCMCIA Sound Card is a 16-bit PCMCIA sound card which occupies a Type II PCMCIA socket in your computer.

The Sound Card contains the Digital Signal Processor (DSP) subsystem and other components, providing the hardware necessary to support:

- A sound system with up to 16-bit 44 KHz stereo playback and recording
- A built-in 3.5-mm stereo input jack
- A built-in 3.5-mm headphone jack.

The DSP allows the Sound Card to provide quality sound to your games and applications. While sound processing is typically a resource-intensive application, the bulk of this processing takes place in the DSP chip of the Sound Card itself, freeing up your central processing unit (CPU) for other tasks.

Audio Support Software

The Sound Card comes with two *applets*, Audio Control and Recorder, which provide you with control over the operation of the Sound Card, as well as recording capability. For further information on these programs, refer to "Audio Functions" on page 14.

MIDI

The Sound Card supports wave-table synthesis for MIDI playback, using actual sampled instruments to provide true-to-life sound. You can play MIDI files using the Windows Media Player.

System Requirements

You will need the following to install the Sound Card:

- An IBM or compatible computer with:
  - An Intel386** SX 25 megahertz (MHz) processor or faster.

- One free PCMCIA Type II socket in your computer.
- Random access memory (RAM) and hard disk storage (minimum):
  - DOS: 1 megabyte (MB) of RAM; 400 kilobytes (KB) of hard disk space
  - Windows**: 4 MB of RAM; 8.5 MB of hard disk space

  We recommend that your computer have 8 MB of RAM for optimum performance.
- Any combination of the following operating systems:
  - DOS 5.0 or higher
  - Windows 3.1 or 3.11, in Enhanced Mode.
- PCMCIA standard version 2.0 (or higher) compliant Card and Socket Services.

Your ability to exploit the features of the Sound Card will vary depending on your selection of application software. Please refer to publications supplied with your applications to determine their requirements and capabilities.

Additional Audio and Hardware Components

You can maximize your use and enjoyment of the Sound Card by using some or all of the following hardware and audio components:

- Powered speakers (which combine an audio amplifier and speaker units). Use two powered speakers for stereo and connect the audio cable from the speakers to the Sound Card's 3.5-mm line-out/headphone connector.

  If you are going to place the speakers near your computer display, ensure that they are shielded in order to avoid distortion of the display's image. The speaker packaging or documentation should indicate whether the speakers are shielded or not.
- Audio Amplifier with speakers. The amplifier should have an available line-in connector (usually labeled Aux or CD, but not Microphone).

  Connect to the headphone/line-out jack.
- Audio equipment to record audio from a compact disc player, tape deck, or other audio device, and play it back.

Connect these devices to the Sound Card using the line-in jack.

Installing the Sound Card in Windows

This section provides you with the information you need to install the Sound Card under Windows. The installation procedure consists of two parts: installing the software under Windows, and installing the Sound Card itself, which is described in “Installing the Hardware” on page 11.

If you intend to use the Sound Card only under DOS, proceed to “Installing the Sound Card in DOS” on page 9.

If you intend to install the Audio Support Software for both DOS and Windows, you should install each part into different directories. While the Sound Card will operate correctly if the software is in a single directory, if you ever need to remove either the DOS or Windows support you will then need to reinstall the Audio Support Software. This is not the case if the software resides in different directories.

Note: Be sure also to refer to the README.TXT file for game-specific information and any last-minute information that may not have been available at the time this book was printed.

Installing the Software

Before proceeding with the software installation, save and close all open applications. Not saving and closing all open applications may result in the loss of data.

To install the audio support software:

1. Insert Disk 1 in your floppy drive.
2. Start Windows.
3. Select File from Program Manager, and then Run. Type `A:\SETUP` and then press Enter. Follow the online instructions.
4. You will be prompted to reboot your computer after the appropriate files have been copied to your hard disk but, before you do so, remove the diskette from your drive and insert the Sound Card into your computer's PCMCIA socket.
5. Shut down Windows (Alt+F4).

6. Reboot your computer (Ctrl+Alt+Del).
7. Attach the line-in/line-out cable.
8. Connect any external audio equipment you intend to use. See "Installing the Hardware" on page 11 for instructions on connecting audio equipment.
9. Restart Windows.
10. Set up your applications to use the Sound Card.
11. Sit back and enjoy the music!

Installation Notes

During the installation procedure the installation software determines whether or not you have Card and Socket Services installed on your computer. Card and Socket Services is software that comes with many notebook computers that manages the memory required by PC Cards and also manages the communication between PCMCIA sockets and PC Card device drivers. The Sound Card can operate both with or without Card and Socket Services.

If you do not have Card and Socket Services you will have to *point-enable* the Sound Card. Point-enabling has the following implications and restrictions:

- Your computer must have an Intel or compatible PCMCIA controller (refer to your system documentation to determine whether this is the case).
- Any cards other than the Sound Card in your machine's PCMCIA socket(s) will not be functional until the system is rebooted with Card and Socket Services reloaded. If the Sound Card is the only PC Card you have then this is not an issue. If you will be using more than one PC Card frequently then you should probably install Card and Socket Services.
- The Sound Card must be inserted into the system PCMCIA socket before you turn your computer on. Hot-plugging (the insertion and/or removal of a PC Card while your computer is running) is not supported without Card and Socket Services.
- You cannot use more than one Sound Card concurrently. Multiple card support is not available without Card Services.

Refer to "Operating Without Card and Socket Services" on page 49 for additional information on operating without Card and Socket Services. Special considerations for specific versions of Card and Socket Services can be found in "APM and Card and Socket Services" on page 29.

During the installation of the Audio Support Software for Windows you also have the option to install the DOS Audio Support Software. For information on the changes that the DOS audio support makes to your system, refer to "Installing the Sound Card in DOS" on page 9.

During the software installation process, the following changes are made to your AUTOEXEC.BAT file:

- The directory `C:\MWW\DLL` is appended to the `PATH` statement.
- A new statement, `LOADHIGH C:\MWW\MANAGER\MWPCMS.EXE`, is added.

The system files SYSTEM.INI and WIN.INI located in the \WINDOWS directory are modified in the installation process. A backup copy of the modified files is put in the \MWW directory. The backup files are SYSTEM.MW*n* and WIN.MW*n*, respectively, where *n* is a number starting from 0.

If you install the software more than once and the .MW0 backup files already exist, the new backup files will have the extension .MW1, and so on.

Files are copied to the \WINDOWS and \WINDOWS\SYSTEM directories, as well as to the default \MWW directory.

After you have successfully completed the installation and restarted Windows, you should hear the default Windows startup .WAV file, TADA.WAV, played through the Sound Card. To test the sound card's MIDI synthesizer capability, play the CANYON.MID MIDI file using the Media Player for Windows (both CANYON.MID and the Media Player program come with Windows).

Note: If you are operating *without* Card and Socket Services (point-enabled), the Sound Card needs to be in the PCMCIA socket all the time (including when the machine is booting up). If you remove the Sound Card, the audio capability is lost until you reboot the machine with the Sound Card back in the socket (hot-plugging is not supported).

Removing the Software

If at some time you need to remove the Audio Support Software you should uninstall the software using the installation program:

1. Start Windows.
2. Insert Disk 1 of the Audio Support Software.
3. Select File and then Run from the Program Manager action bar.
4. Type `a:setup` and press the Enter key.
5. On the Select Installation Type dialog box, select Remove Installation.
6. Follow the online instructions.

Note: Removing the Audio Support Software will also remove the directories in which the software is contained, along with any data files you may have stored in those directories. You have the opportunity during the software removal process to move any files you don't want deleted from these directories into another directory.

Installing the Sound Card in DOS

This section provides you with the information you need to install the Sound Card under DOS.

Note: If you intend to install the Audio Support Software for both DOS and Windows, you should install each part into different directories. While the Sound Card will operate correctly if the software is in a single directory, if you ever need to remove either the DOS or Windows support you will then need to reinstall the Audio Support Software. This is not the case if the software resides in different directories.

The DOS Audio Support Software provides you with the ability to play most Sound Blaster- and Ad Lib-compatible games using the Sound Card. Refer to the README.DOS file for a complete list of games that have been tested, as well as additional tips on playing specific games.

The installation procedure consists of two parts: installing the software under DOS, and installing the Sound Card itself, which is described in "Installing the Hardware" on page 11.

If you intend only to use the Sound Card under Windows, refer to "Installing the Sound Card in Windows" on page 5, instead of this section.

Installing the Software

1. Insert Disk 1 in your floppy drive.
2. At the command prompt, type: `A:\INSTALL`. Follow the online instructions.
3. You will be prompted to reboot your computer after the appropriate files have been copied to your hard disk but, before you do so, remove the diskette from your drive and insert the Sound Card into your computer's PCMCIA socket.
4. Reboot your computer (Ctrl+Alt+Del).
5. Attach the line-in/line-out cable. and connect any external audio equipment you intend to use. See "Installing the Hardware" on page 11 for instructions on connecting audio equipment.
6. Set up your applications to use the Sound Card.
7. Sit back and enjoy the music!

Installation Notes

When you install the Audio Support Software for DOS, the following changes are made to your AUTOEXEC.BAT file (the default changes are shown):

```
PATH=....existing path...;C:\MWD\MANAGER
LOADHIGH C:\MWD\MANAGER\MWPCMS.EXE
SET MWROOT=C:\MWD
SET MWPATH=C:\MWD\MANAGER;C:\MWD\MWGAMES
LOADHIGH C:\MWD\MANAGER\MWGAME.EXE
```

MWPCMS.EXE is required to use the Sound Card in both the Windows and DOS environment. MWDGAME.EXE supports DOS games running in native DOS. If you intend to use the Sound Card in a Windows environment only, you can remove the `MWDGAME.EXE` statement from your AUTOEXEC.BAT file.

Removing the Software

If you need to remove the DOS Audio Support Software at some point, do the following:

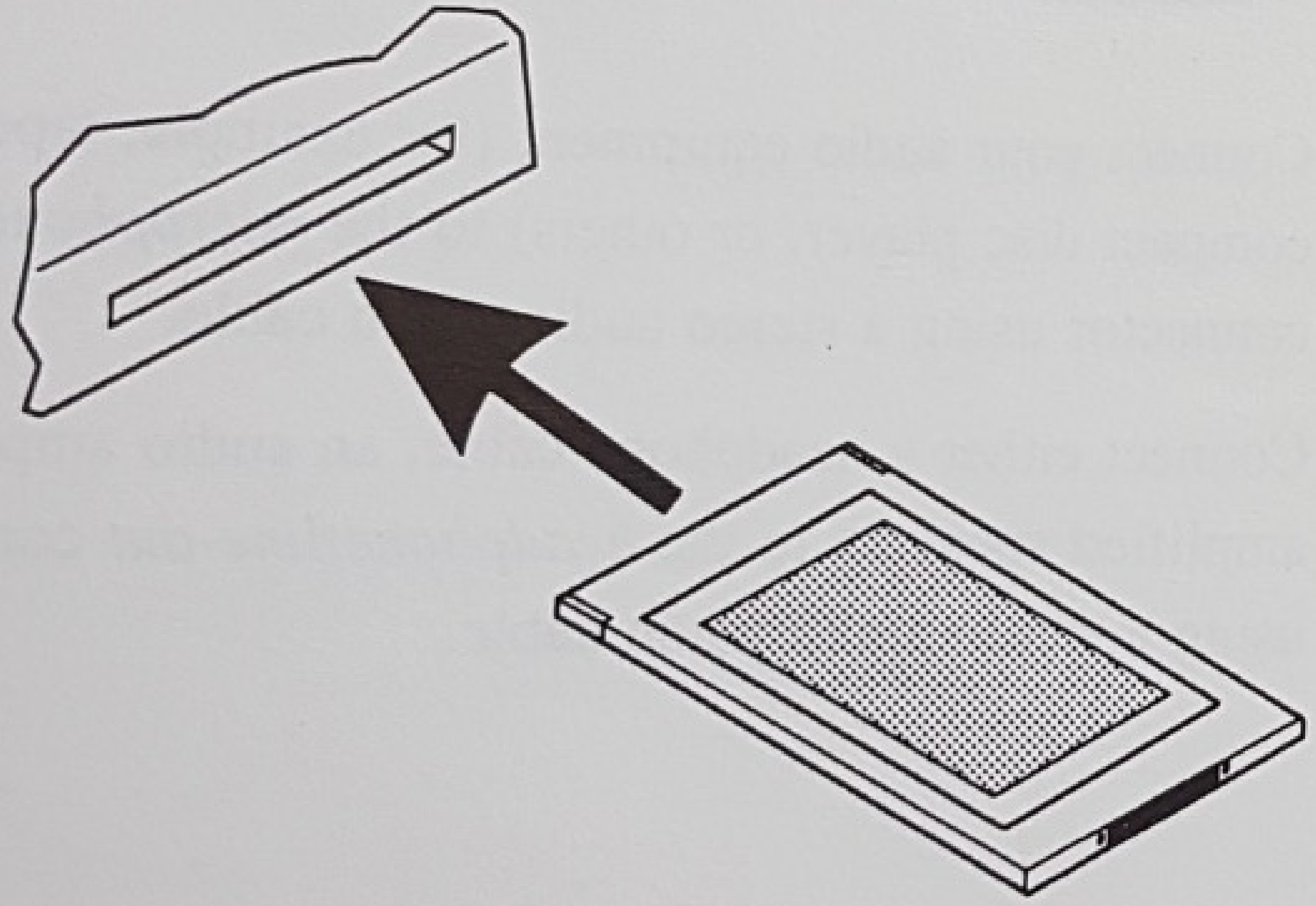
1. Go to the directory where the DOS Audio Support Software is located (typically /MWD).
2. Type `UNINSTAL` and press the Enter key.
3. You are asked to confirm whether you wish to delete all the files. Type `Y` to proceed, or `N` to cancel.

Installing the Hardware

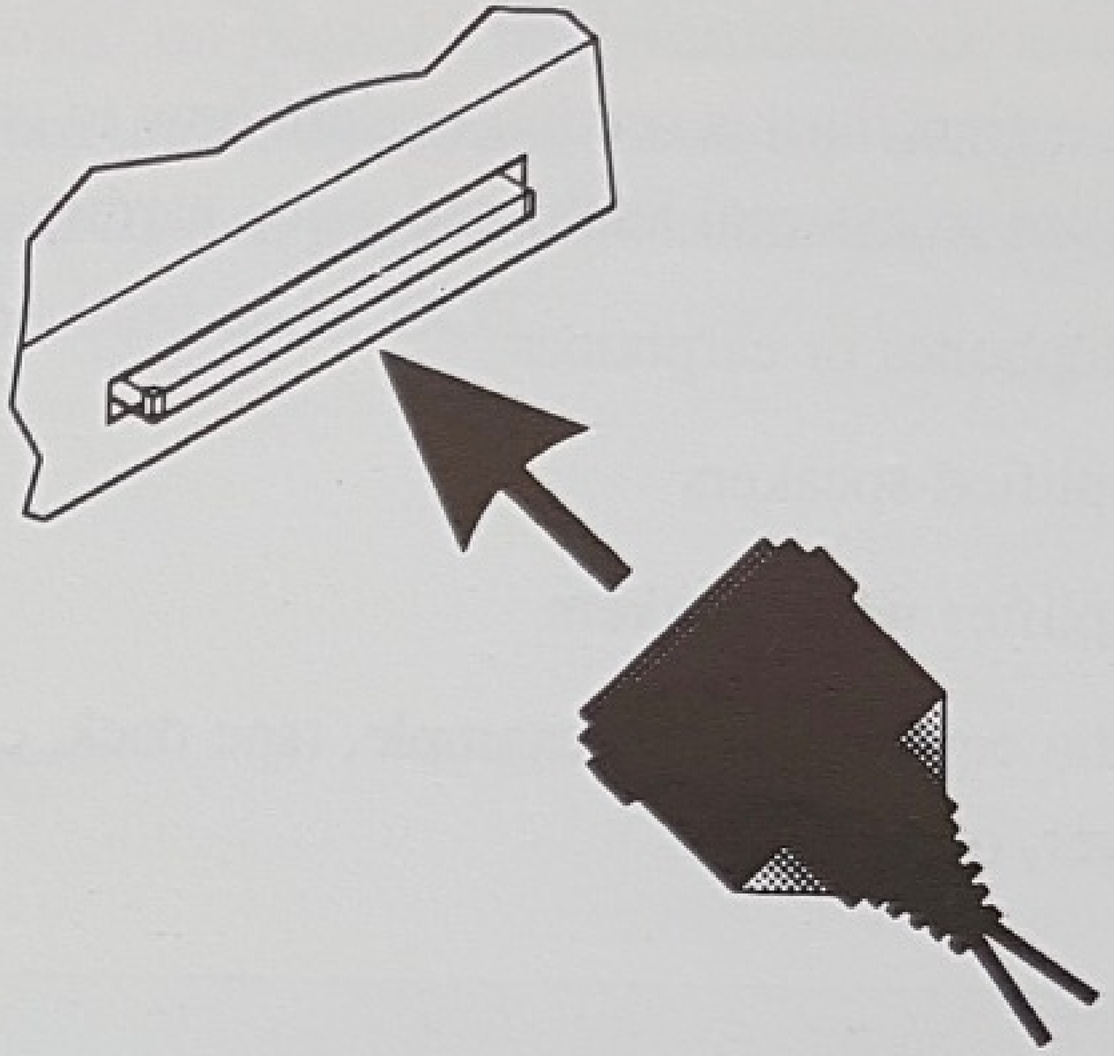
To install the Sound Card, do the following:

1. Locate the PCMCIA socket on your computer. If your computer supports the enabling (powering on and off) of the PCMCIA socket, ensure that the socket is powered on. Refer to your computer's documentation for instructions on how to do this.

   Insert the Sound Card in the socket.



2. Connect the line-in/line-out cable to the Sound Card.



3. If your computer was off, turn it on.
4. Proceed to the next section to connect your audio equipment.

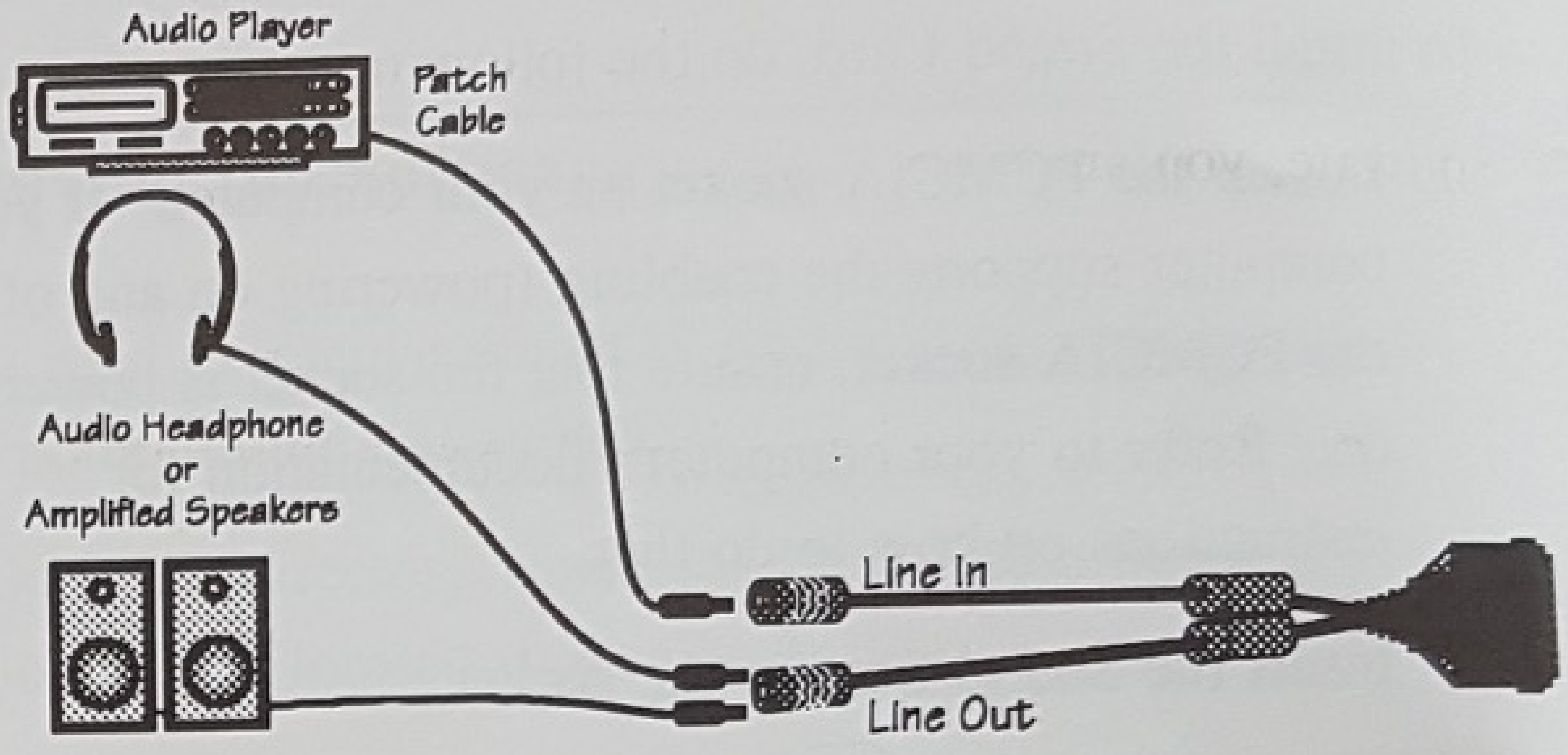
Connecting Audio and Other Equipment

The instructions in this section explain how to connect the Sound Card to external audio and game hardware such as:

- Headphones or earphones
- Amplified speakers
- Amplifier with speakers
- Audio equipment (for example, tape deck, compact disc player, or others)

> **Caution:** Turn power off to all external hardware before connecting their cables to the Sound Card. Please exercise care when connecting input and output cables to the Sound Card.

1. Review the connection of the external audio equipment to the line-in/line-out cable as shown in the following figure.



2. Connect your audio equipment (for example, tape deck, compact disc player, or others) to the *microphone/line-in* connector using a stereo audio patch cable.
3. Connect either a headphone cable, an audio amplifier, or amplified speakers to the *headphone/line-out* connector using a stereo audio patch cable.

Installation Is Complete

Assuming that you have already installed the Audio Support Software, you are done - the Sound Card installation is now complete!

You may now install your own applications in order to enjoy your new Sound Card. Please refer to "Using Your Sound Card in Windows" on page 14 for information on how to use your Sound Card under Windows. Refer to "Using Your Sound Card in DOS" on page 31 for information on how to use your Sound Card under DOS.

Using Your Sound Card in Windows

This chapter provides you with information on using the Sound Card to play and record audio files, play games, and also provides some tips on getting the most out of your Sound Card. Besides verifying that the Sound Card is working properly, it's time that you heard some music.

Be sure also to refer to the README.TXT file for game-specific information and any last-minute information that may not have been available at the time this book was printed.

Audio Functions

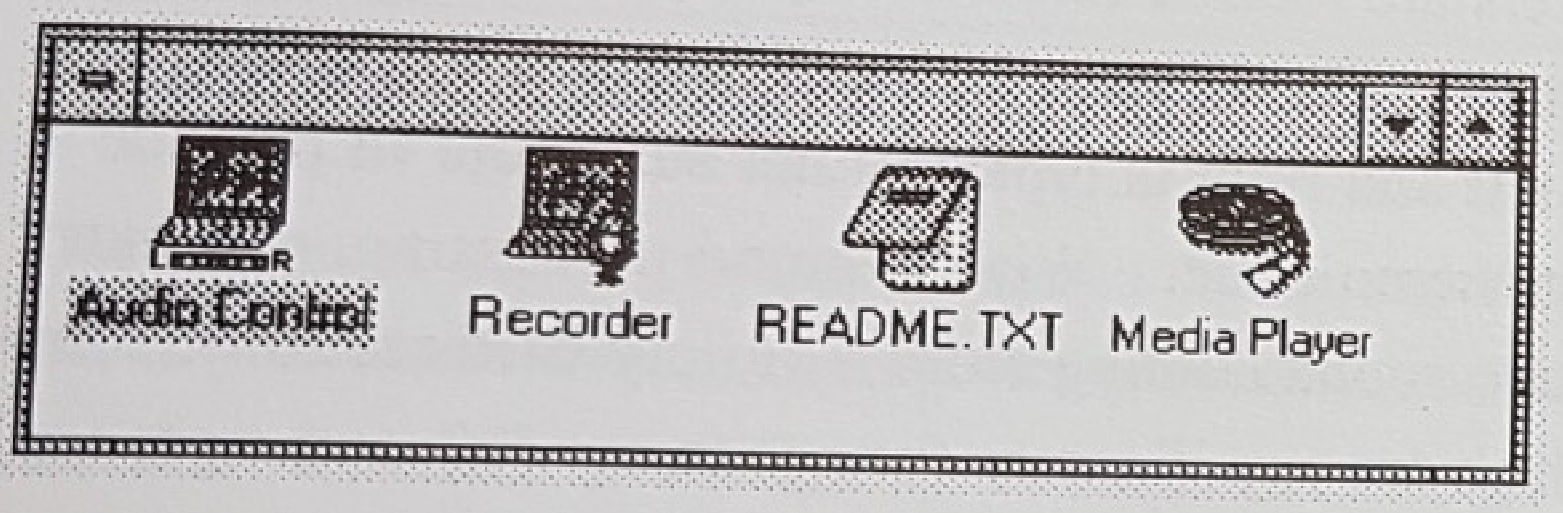
The Audio Support Software provides support for Windows audio applications that comply with the Windows MultiMedia Extensions (MME) for audio, such as Windows Sound Recorder and Windows Media Player, shipped with Windows 3.1.

The Audio Support Software includes two audio applets, Audio Control and Recorder, which provide you with the ability to control the operation of the Sound Card and control audio recording with some editing capability, respectively.

Audio Mixer Panel

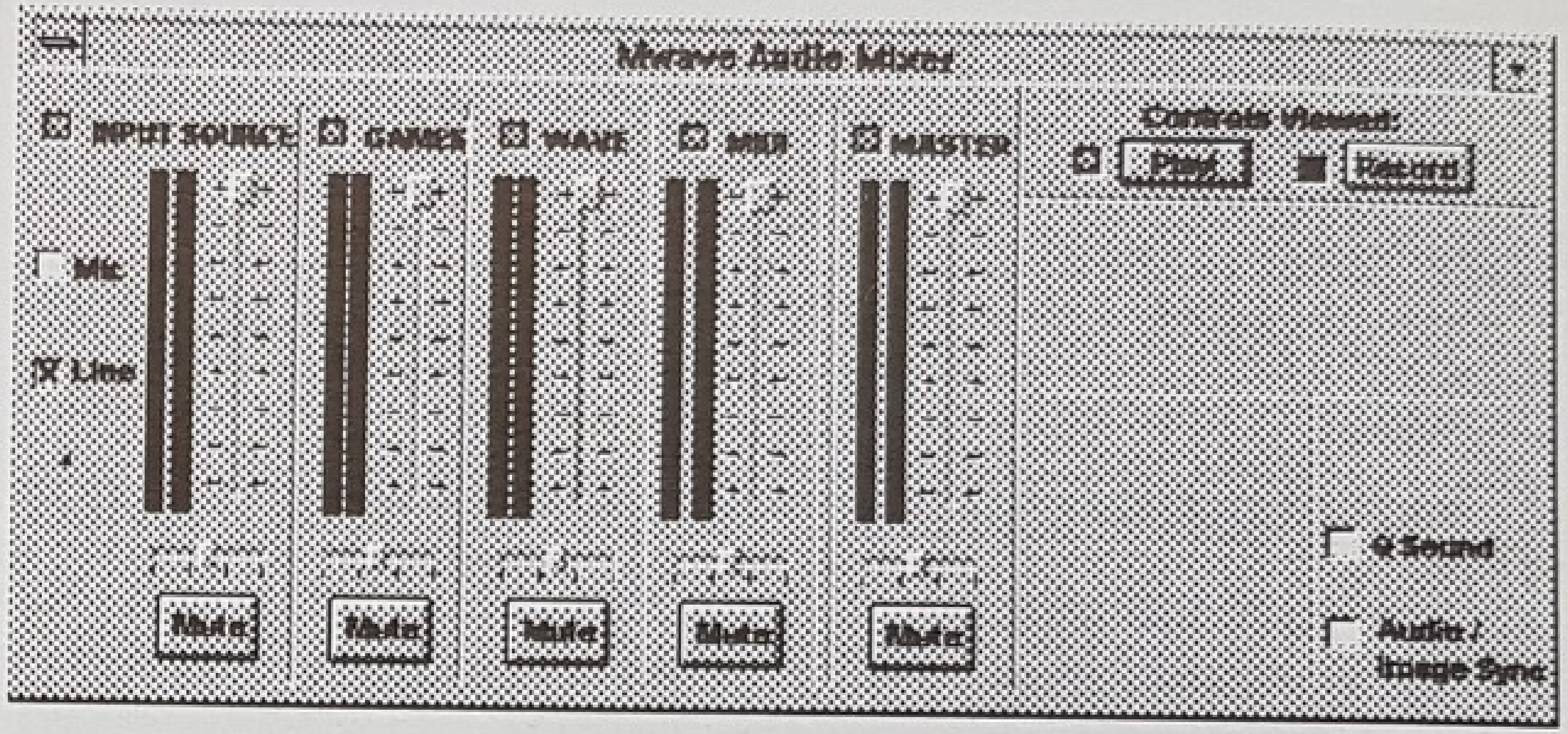
The Audio Mixer panel allows you to control the sound levels of your Sound Card, as well as providing you with some flexibility in the operation of the Sound Card.

To start Audio Mixer, double-click on the Audio Control icon:



The Audio Mixer panel is similar to a mixing board, allowing you to adjust the volume and balance, audio inputs and outputs, master volume, and providing audio enhancement options with QSound and Audio/Image Synch.

The Audio Mixer has two views, Play and Record. If you are in Play mode, the panels will show the output controls. In Record mode, the input controls are shown. Here we see Play mode:



Output Controls (Play Mode)

The Games, Wave and MIDI controls allow you to control the volume and balance for each output signal separately.

Master Controls (Play and Record Mode)

Master Record and Master Play allow you to adjust the audio input and output signals as a group.

Input Controls (Record Mode)

The Mic and Line checkboxes allow you to select the audio source. The vertical sliders control the recording level and the horizontal sliders control the balance (left and right). The Mute button shuts the volume off completely. Mute is indicated by the box beside the volume control going "off" or a dull color.

Audio/Image Synch

Some games and screen saver applications use sound which is synchronized with animation. If you are using such programs and the sound or animation is slower than you expect, select the Audio/Image Synch check box. Using Audio/Image Synch provides increased response speed during waveform playback.

Note: Selecting this function improves response at the expense of available DSP resources, which may hamper your ability to use some applications concurrently.

To return to normal operations, deselect the check box.

QSound

To enable the QSound audio enhancement, select the QSound check box. QSound is a signal processing technique which improves the quality of stereo output by adjusting the sound so that it seems as if your speakers are further apart than they really are, as well as making sound seem to come from a variety of directions other than from where your speakers are physically located.

This is particularly useful for a personal computer system, in which table space is limited and a small set of speakers are located immediately adjacent to the computer. The distance between you and the speakers to your left and right is typically not sufficient to provide a decent stereo effect. With QSound processing, you can perceive sound coming from a variety of directions, some of which are significantly further to the left and right than the actual location of the speakers. The net result is a significantly improved stereo effect.

To achieve the full effect of the QSound process, you should sit directly in front of the computer with the speakers equally distant from both sides of your computer.

Notes:

1. Selecting this function improves response at the expense of available DSP resources, which may hamper your ability to use some applications concurrently.
2. QSound cannot be used when playing MIDI files.

Recorder

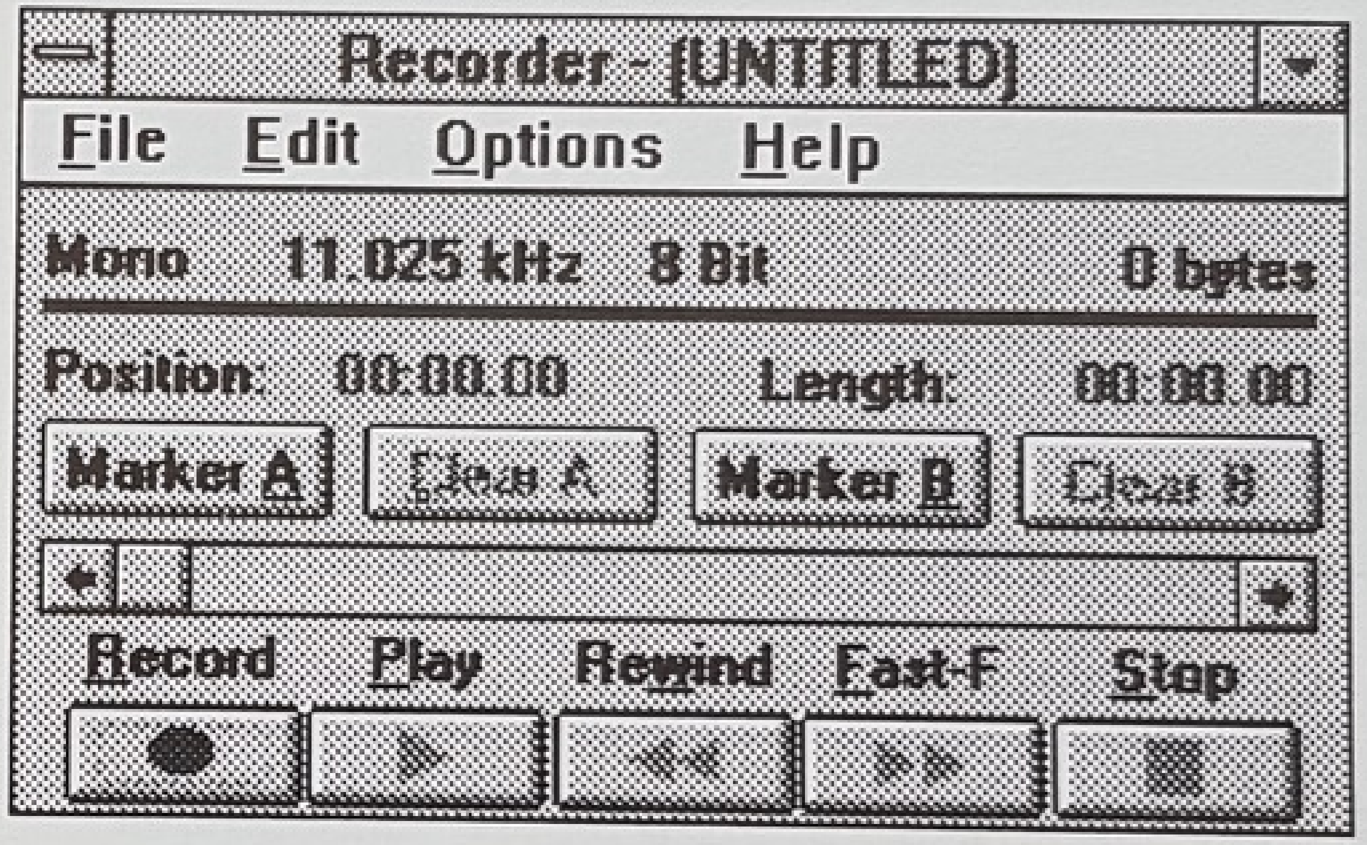
This applet is similar to the Windows 3.1 Sound Recorder in that it provides wave recording and playback functions. In addition, Recorder provides some unique recording features for the Sound Card.

With Recorder you can record .WAV files in each audio mode supported by the Sound Card. You can select:

- 8- or 16-bit samples
- Mono or stereo mode
- Sampling rates of 11 KHz, 22 KHz, 44 KHz, or a variable sampling rate from 6 to 20 KHz.

File size information is shown while you record, and you can use the Play, Rewind, and Fast Forward functions to move around within the file. You also have the capability to do some simple wave editing using the Marker buttons.

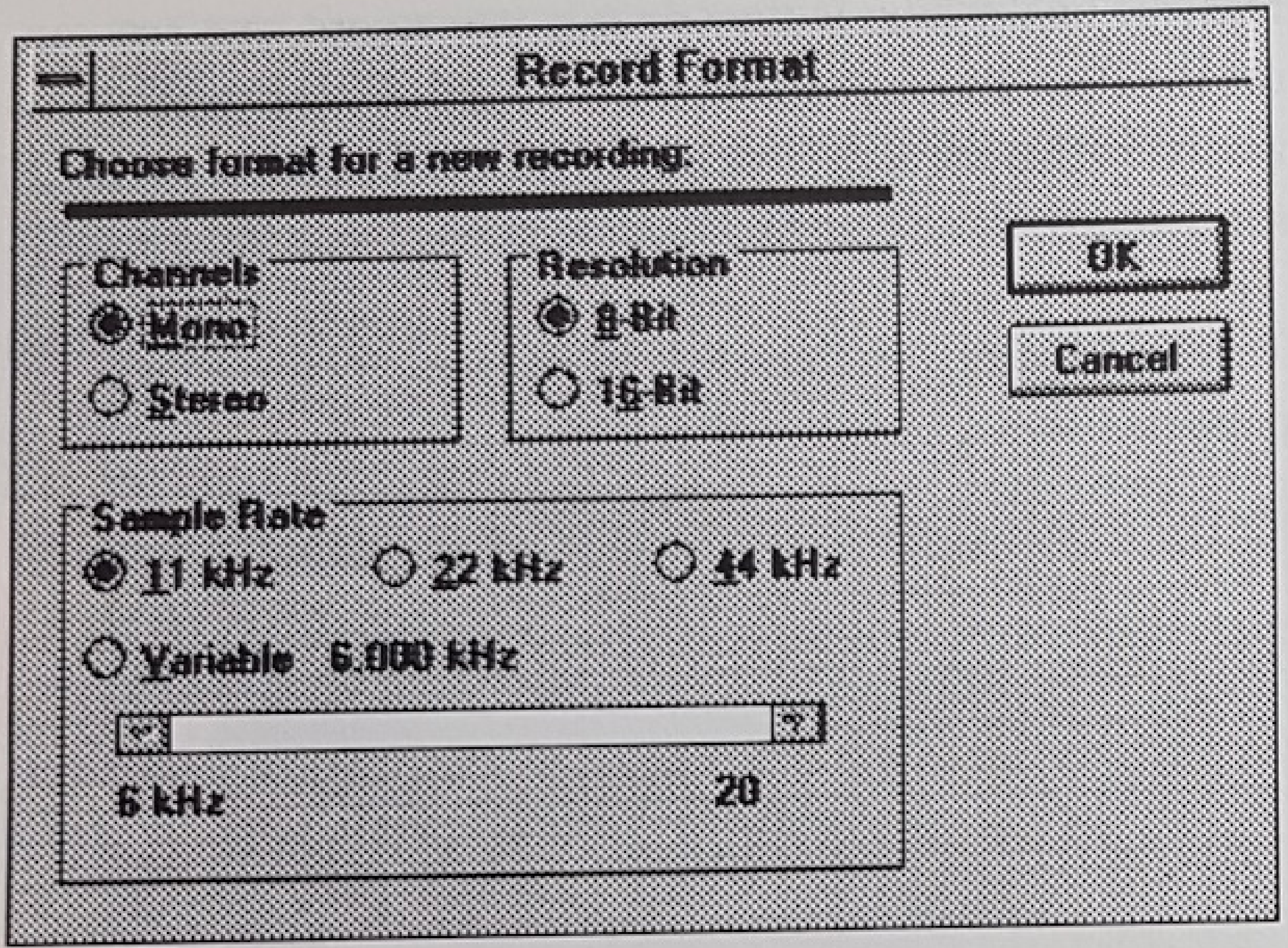
To start Recorder, double-click on its icon. You are then presented with a screen similar to this:



Mono 11.025 kHz 8 Bit 0 bytes

Position: 00:00.00 Length: 00:00.00

Select the recording format by clicking on Options in the Recorder action bar and selecting Record Format from the pulldown. The Record Format screen is displayed, and you can then select the recording format you wish to use.



Choose format for a new recording:

Channels
- ● Mono
- ○ Stereo

Resolution
- ● 8-Bit
- ○ 16-Bit

Sample Rate
- ● 11 kHz
- ○ 22 kHz
- ○ 44 kHz
- ○ Variable 6.000 kHz

6 kHz 20

To record a new sound file, select the appropriate recording format and start recording by clicking on the Record button in the Record panel. This begins the recording at the position indicated by the position counter (which is zero when you record for the first time). On subsequent recordings within the same file, recording will begin at the position to which the counter points.

You can change the position counter's value by moving the file position indicator using your mouse pointer: click on the position counter and move the mouse left or right until you have located the desired position.

To play back a recording, click on Rewind, which moves the position counter to the beginning of the file, and then click on Play to play the file back. To play an existing .WAV file recording, select File and Open and then click on Play.

To play back the recording at a position other than the beginning of the file, reposition the file position indicator to where you want the file to play back from and click on Play.

Recorder permits some simple editing of .WAV files. You can delete part of the file, insert other .WAV files into the file, or record over some or all of the file. To edit a file you use the Marker buttons.

The first time you select the Marker A and Marker B buttons, the file positions associated with these markers are saved and you can only clear them by selecting the Clear A and Clear B buttons, respectively, or by performing an action which uses the markers (such as Delete).

To delete a portion of a recording, select the beginning of the part to be deleted by pressing Marker A when the file position indicator is at the beginning of the part you wish to delete from the file. Select the end of the part to be deleted by pressing Marker B when the file position indicator is at the end of the part of the file you wish to delete. Now Marker A points to the beginning and Marker B to the end of the portion of the file to be deleted. Click on Edit and then Delete. The part of the file you selected is deleted and Marker A and Marker B are cleared.

To insert a new recording into an existing file, select the place where the insertion should occur by pressing Marker A when the file position indicator is at the point where you wish to start inserting a recording. With recording and playback stopped, press Marker A again which repositions the file to the insertion point. Select the Record button to begin recording. The new recording is inserted into the file until you click on the Stop button.

To save a recording, select File and then Save or Save as.

Using a Microphone

The line-in jack is intended primarily for connecting powered input devices like CD players. You may also connect an external microphone to the line-in jack and set the Record Source to Mic in the Audio Mixer panel. To ensure maximum audio fidelity when you record using a microphone, do the following:

- Set Record Source to Mic in the Audio Mixer panel. If you are using line input (from a CD player, for instance), set the recording source to CD+Line, otherwise distortion may occur.
- Try to talk at a relatively uniform volume level into the microphone. Avoid extremes in volume, both loud and soft.
- Experiment by talking at different distances and angles to your microphone to see which combination best suits your voice.

- Be sure to always point a microphone *away* from speakers. If a microphone is pointed in the direction of a speaker, an audible whine may occur due to feedback between the speakers and the microphone. If feedback remains a problem, increase the distance between the microphone and the speakers, or turn off the speakers completely.

MIDI Introduction

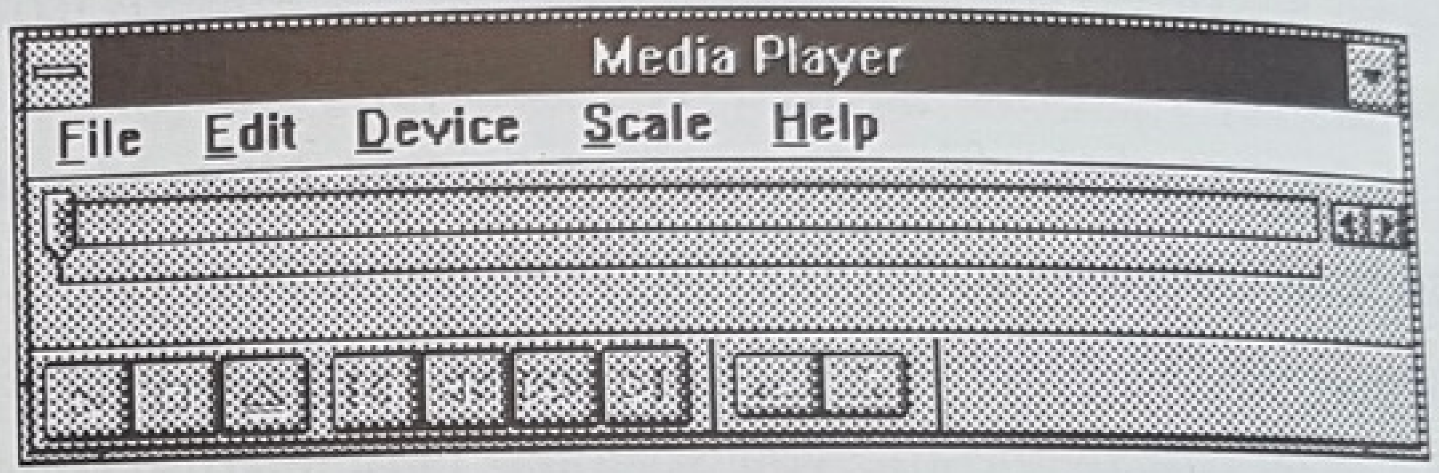
Your Sound Card can act as if it were a music synthesizer, creating realistic instrument sounds from a sequence of MIDI commands read from a MIDI file on your PC.

The Musical Instrument Digital Interface (MIDI) standard defines a very compact representation for music. The MIDI data stream is composed of a sequence of commands representing musical events, such as the pressing of a key on a piano keyboard. For details on the MIDI data stream and a more technical discussion of the Sound Card's MIDI support, refer to "MIDI Audio" on page 60.

Playing MIDI Files

To play MIDI files use the Media Player that comes with Windows 3.1. To play a MIDI file, do the following:

1. Open the Windows Accessories Program Group. Double-click on the Media Player icon to start it.



When the Media Player screen appears, select Device from the action bar and then select Midi Sequencer. You will then be presented with the Open screen.

2. Highlight CANYON.MID (for example) and click on OK.
3. You can now begin playing CANYON.MID by clicking on the Play button. The Media Player screen will change to indicate that the file is playing; the pause and stop controls will be highlighted to indicate that they can be used to control playing of the file.

Understanding the MIDI Mapper

The MIDI Mapper is a program included with Microsoft Windows that interacts with the Audio Support Software MIDI device driver to control the way sounds are created on your Sound Card and on external MIDI devices, like keyboards. In Windows, MIDI applications allowing you to specify a MIDI output device select the Windows MIDI Mapper as the output device, rather than outputting to the MIDI device driver directly.

If you have a MIDI file that is not producing sound on your Sound Card it could be because MIDI commands are being sent on a set of channels the MIDI Mapper is not responding to. The MPC standard provides for two MIDI datastreams (Base and Extended) and your MIDI file may be composed of only one of these datastreams. See "Base and Extended MIDI Maps" for additional information.

Use the Windows MIDI Mapper to switch the setup between Base and Extended Multitimbral modes if you are not getting sound when playing a particular MIDI composition:

Base Multitimbral (ch 13-16)	Mwave Base GM
Extended Multitimbral (ch 1-10)	Mwave Ext. GM

Base and Extended MIDI Maps: The MPC standard requires that MIDI authors provide two versions of every MIDI composition stored in a single MIDI file: Base and Extended Multitimbral. Channels 13-16 hold the version written for Base Multitimbral, which supports up to eight simultaneous voices or notes. Channels 1-10 hold the version written for Extended Multitimbral, which supports up to 32 simultaneous voices.

The Sound Card MIDI device driver is a Base Multitimbral synthesizer, since it supports eight voices. While the MIDI device driver is meant to play the Base Multitimbral data on MIDI channels 13-16, a MIDI map is also provided to play Extended Multitimbral data contained on channels 1 through 10. In this mode, a few songs requiring more than 8 simultaneous voices may sound odd: if a 9th simultaneous note is played, the "oldest" note will end prematurely.

Playing Games in the Windows DOS Box

The Sound Card provides audio for most DOS and Windows games. A small number of games run in DOS Protected Mode and do not work with the Sound Card in Windows. (See the README.TXT file for examples).

The Sound Card software supports most Sound Blaster- and Ad Lib-compatible games. When you set up a game, you should first select Sound Blaster or Sound Blaster compatible as the sound card to use. Many games will detect and select this interface automatically. If you find that the Sound Blaster or compatible interface is not providing you with the results you expect, try Ad Lib as an alternative.

In addition, the sound effect quality produced by the Sound Card may be affected by the game's CPU resource requirement. If you hear a lot of static noise in the sound effects during game play, you can choose to disable the sound effects and use Adlib support only.

Many games will require that you create a program information file (PIF) in order to allocate the appropriate amount and type of memory to play the game. Refer to your Windows documentation to find out more information on PIF and how it can be used to make EMS or XMS memory available in the Windows DOS box.

If the game hangs or sound problems occur, you may need to change some of the settings for the port address, IRQ, or DMA channel to eliminate conflicts with other cards or computer equipment, or set up the Sound Card for the unique requirements of a specific game.

Port Address, Interrupt Line and DMA Channel

Most games automatically determine the port address, interrupt line, and DMA channel settings for your sound card. If the game asks you to specify this information, select a port address of 220, IRQ of 7, and a DMA Channel of 1. These are the default settings in the Sound Card software for games.

In the event that you need to change these settings (in order to eliminate an IRQ conflict for example), you can do so with the Mwave DOS Games Setup panel. To get to the Setup panel, open the Control Panel application from the Main program group of Windows and then double-click on the Drivers icon. Click on Mwave Games in the list of device drivers and then click on the Setup button. The Setup panel appears, allowing you to change these settings. Once you have finished, you should set up any games you may be playing under Windows to use the new settings.

Playing Games in the Windows DOS Box

To start a DOS game from Windows, choose one of the following procedures:

- From the Main Program Group, double click on the MS-DOS Prompt icon and follow the game's user manual for starting the game.
- From the game's directory enter `WIN` followed by the startup command for the game. This will start Windows, go to a DOS session under Windows, and start the game.

For example:

```
WIN XWING
```

When you finish the game, you can exit Windows by pressing the Alt+F4 keys and then pressing the Enter key.

Adjusting the Volume

To adjust the volume while you are playing a game:

Increase Volume	Ctrl+Alt+U
Decrease Volume	Ctrl+Alt+D

Note: Certain games *trap* keyboard input while they are being played. For these games, volume control cannot be adjusted with this method. Refer to the game's documentation for information on adjusting the volume during play.

Improving DOS Games Performance

A few DOS games run more slowly in a Windows DOS session than in native DOS. Check the user manual of your game for special instructions about improving performance. Also, configure Windows to use the VGA display driver rather than a higher resolution or less efficient driver. If performance is still slow, see if your game allows you to turn off special effects and only play "background music".

Trouble-shooting Problems with DOS Games

The manufacturers of DOS games use a wide variety of techniques to give their games unique functions and performance. This diversity may cause problems for you. You should refer to the game's user manual for information that can assist you in setting up the game properly and also for hints and tips on maximizing performance. The game manufacturers usually provide extensive help and suggestions to overcome problems unique to their game.

Disabling DOS Games Audio

The Setup panel also contains the Enable Game control. (Select Setup, then Control Panel, then Drivers, then Mwave Games.) Selecting this box enables the Sound Card's DOS Games Audio option and deselecting the box disables it. One reason for disabling the Sound Card's DOS Games Audio option would be to allow for the operation of another sound card in your computer. If you want to use a different sound card just for games, and the Sound Card for other applications, remove the X from the Enable Game box by clicking on it.

Optimizing Your Use of the Sound Card

This section provides you with information about how to get the best performance from the Sound Card, including hints and tips on configuring the sound card, as well as some trouble-shooting information.

EMM386.EXE

In order to improve audio performance, you should load the Expanded Memory Manager EMM386.EXE and disk caching utility SMARTDRV.EXE, provided by the Windows default installation. See your DOS or Windows user guide for information on using and configuring EMM386.EXE and SMARTDRV.EXE.

Note that you will need to exclude certain portions of memory from use by EMM386.EXE, depending on whether you are using Card and Socket Services or not. If your system came with Card and Socket Services installed, then the memory areas that it uses will most likely have been excluded already.

Check your Card and Socket Service or system documentation for details on configuring and using your version of Card and Socket Services.

If you are operating point-enabled, you will need to exclude EMM386.EXE's use of the 12K memory window you define with the MWPCMS.EXE program in your CONFIG.SYS file. If you elected to point-enable the Sound Card during the Audio Support Software installation process, then the configuration of MWPCMS.EXE and EMM386.EXE will have been done for you automatically. Refer to "MWPCMS.EXE" on page 50 for further information.

If you encounter some instability in the Windows environment when you use the Sound Card, use a text editor to add an `EMMEXCLUDE` statement in the [386Enh] section of your SYSTEM.INI file (located in the \WINDOWS directory) to exclude the memory window that your Card and Socket Services is using. The `EMMEXCLUDE` statement informs Windows not to use the area of high memory being allocated to Card and Socket Services. For example:

```
[386Enh]
EmmExclude=C800-CFFF
```

Most popular Card and Socket Services vendors also provide utility programs to allow you to display or change the high memory configuration.

For detailed information on Card and Socket Services, refer to "About Card and Socket Services" on page 44.

Other Memory Managers

In order to get the maximum amount of conventional memory for a game in DOS, you can use highly enhanced and optimized memory managers like QEMM** or 386MAX**. Refer to the documentation that came with these memory managers to understand how to configure and optimize them.

Games Requiring More Than 1024K of EMS or XMS Memory

If your game requires more than 1024K of EMS or XMS memory, you may need to edit the PIF file for the Windows DOS session: in the file DOSPRMPT.PIF, find the entries labeled "EMS Memory:" and "XMS Memory:", and enter the amount of memory required by your game. Refer to your Windows User Guide if you need help using the PIF Editor. Refer to your game's documentation to determine its memory requirements.

Improving Recording and Playback Quality

Your ability to record and play back high-quality audio files can depend on several factors relating to your computer and its environment, such as computer speed, channel speed, disk performance (speed and fragmentation) and memory. If you record audio and find sections of good audio intermixed with noise, sections of good audio intermixed with silence, or static or skipping, then you are probably running into performance problems.

You can try to alleviate the problem using some or all of the following suggestions. You should refer to your operating system documentation for information on how to do the following activities.

Recording

- Make sure that verify is off on disk writes.
- Use a RAM disk, also called a virtual disk, as the file destination of a recording.
- Defragment the hard disk before recording.
- Record as a foreground activity.
- Increase your cache size using SMARTDRV. Alternatively, you can change the record buffer size by double-clicking on Drivers in the Windows Control Panel, selecting MCI Sound and then Settings.

Playback

- Move the audio file to a RAM disk and play it from that location.
- Increase your cache size using SMARTDRV. Alternatively, you can change the playback buffer size by double-clicking on Drivers in the Windows Control Panel, selecting MCI Sound and then Settings.

If these suggestions do not improve performance, you may require a faster computer to use faster data rate modes. If you have a slower performance computer, try using the lower data rate modes (22,000 mono samples per second, for example) to ensure proper operation.

Selecting an Audio Mode

The Sound Card offers a wide variety of audio modes to be used in many applications. Audio mode refers to the combination of sample width, sample rate, and number of channels. Your choice of audio modes may be influenced by the following factors:

Sound Quality

Higher quality audio requires more computer storage: 16-bit audio samples require twice the storage of 8-bit audio samples.

Mono or Stereo

Stereo (two channels) requires twice the storage of mono (one channel).

Sampling Rate

Doubling the sampling rate doubles the storage requirement for a given audio format since there are twice as many audio samples.

Storage

Audio files may become very large and use up an excessive amount of your computer's available memory.

Audio Storage

To provide a feeling for the size of the computer files created by the Sound Card's various audio modes, consider the following chart, which summarizes the storage requirements for files recorded in different modes.

Table 1. Storage Requirements for Mono Audio

Sample Width and Sample Rate	**Bytes/Minute**
16-bit, 44,100/sec	5.3 MB
16-bit, 22,050/sec 8-bit, 44,100/sec	2.6 MB
16-bit, 11,025/sec 8-bit, 22,050/sec	1.3 MB
8-bit, 11,025/sec	660K

Notes and Definition of Terms:

- "MB" = megabytes "Hz" = cycles per second
- Recording in stereo doubles these numbers.
- Most values are rounded off.

Sampling Rate: Each audio sample is a digital representation of the instantaneous magnitude of the analog audio signal. The higher the sampling rate and the more bits per sample (that is, a wider sample width), the more accurate the representation of the original audio signal. Stereo is achieved by sequencing a sample of the left channel audio signal followed by a sample of the right channel audio signal.

There is no one sampling rate that is best. Doubling the sampling rate approximately doubles the audio frequency response, but also doubles the storage requirements. This is why a wide range of available sampling rates is so important to satisfy a variety of needs.

8-Bit and 16-Bit Audio Data: The Sound Card can process both 8-bit and 16-bit audio data. 8-bit capability provides compatibility with applications that create audio data with older 8-bit sound cards. Since 8-bit audio is subject to a great deal of noise, the Sound Card also supports 16-bit audio technology for improved audio quality. In a noisy environment, 8-bit audio might be very useful if memory space is limited, as the ambient noise may mask much of the noise from the 8-bit technology.

For additional information on digital audio file formats, refer to “Waveform Audio” on page 60.

Power Management Support

This section provides information you should consider if you use Advanced Power Management (APM) under Windows.

Hot-plugging

Hot-plugging is the insertion or removal of the Sound Card while your computer is on. The Sound Card supports hot-plugging and power management in Windows, however you should wait at least five seconds between removing and reinserting the Sound Card into the PCMCIA socket.

APM and Card and Socket Services

In order to ensure normal suspend or resume and other power management operations, make sure that Windows setup is configured to use APM support. APM support is not available when the Sound Card is point-enabled (when you use it without Card and Socket Services). You may also need to create a special configuration for your version of Card and Socket Services in order to support Advanced Power Management. The following information describes some of the special considerations, depending on your version of Card and Socket Services.

IBM EZPLAY Version 2.0 or Higher: No special configuration is required for APM support.

Phoenix Card Manager 3.0 or Higher: After any suspend or resume operation, you will need to hot-plug (remove the sound card from PCMCIA socket and re-insert it after five seconds) to ensure all sound drivers are properly reloaded and functional.

SystemSoft Cardsoft 2.1 or Higher: You may need to load the CS_APM.EXE program in the CONFIG.SYS file of your system to fully support power management in Windows. This program may not be available with Cardsoft version 2.1.

Award Cardware 2.0 or Higher: This Card and Socket Services software supports limited power management in Windows: suspend and resume are not supported; hot-plugging is supported.

Using Your Sound Card in DOS

This chapter provides you with the information you require to play games and provides some tips on getting the most out of your Sound Card in the DOS environment.

Note: Be sure also to refer to the README.DOS file for game-specific information and any last-minute information that may not have been available at the time this book was printed.

Hot-plugging in DOS

The Sound Card supports hot-plugging in DOS, subject to the following requirements:

- No program is currently active and there are no programs that use the Sound Card currently in memory.
- You are using supported Card and Socket Services software. See the README.DOS file for a list of supported Card and Socket Services software.

In order to conserve battery power, you should remove the Sound Card from your computer's PCMCIA socket when it is not being used, and reinsert it when you want to use it again.

Games Support

The Sound Card software supports most Sound Blaster- and Adlib-compatible games. When you set up a game, you should first select Sound Blaster or Sound Blaster compatible as the sound card to use. Many games will detect and select this interface automatically. If you find that the Sound Blaster or compatible interface is not providing you with the results you expect, try Ad Lib instead.

If the game hangs or sound problems occur, you may need to change some of the settings for the port address, IRQ, or DMA channel to eliminate conflicts with other cards or computer equipment, or set up the Sound Card for the unique requirements of a specific game.

A small number of games run in DOS Protected Mode and do not work with the Sound Card. (See the README.DOS file for a detailed list).

Setting the Port Address, IRQ and DMA Channel

Most games require that you identify the port address, IRQ and DMA channel of the sound card that you are using. The Sound Card DOS Audio Support Software uses the most common settings of 220 (port address), 7 (IRQ) and 1 (DMA channel). While these settings should be fine for most games and for most computers, you may find that you have to change these settings in order to resolve an IRQ conflict, or meet the special needs of a particular game. These settings are contained in the MWAVE.INI file, which is located in the \MWD directory. To change these settings you can open the file with a text editor and look for the following lines:

```
[DOSGames]
Port=220h
Int=7
DMAChannel=1
Compatibility=0
```

`Port` refers to the port address of the Sound Card, `Int` to the IRQ, and `DMAChannel` to the direct memory access channel. Each of these settings can be changed to meet the needs of a particular game or to eliminate conflicts in your computer system. Compatibility is a switch you can change to provide support for a wide variety of games, or to meet the needs of a specific game. The Compatibility setting for all of the games tested with the Sound Card is contained in the README.DOS file.

The settings can be changed as follows:

Port	220h, 240h, or 260h.
Int	5 or 7.
DMAChannel	0 or 1.
Compatibility	0 to 7.

To specify an IRQ of 5 for example, you would change the `Int=7` line to `Int=5`. When you are finished making your changes, save the file. You will need to reboot your computer in order for the changes to take effect.

The following sections provide additional information to assist you in selecting the appropriate values for the MWAVE.INI statements.

Port Address

One of the following three sets of port addresses (also known as I/O ports) is required for the Sound Card to support .WAV play (sound effects) and FM Synthesis (background music) in DOS games:

200-22F and 388-38F
Supports .WAV file play at I/O 220H and FM synthesis

240-24F and 388-38F
Supports .WAV file play at I/O 240H and FM synthesis

260-26F and 388-38F
Supports .WAV file play at I/O 260H and FM synthesis.

To ensure that your selected port address is available for use by Card and Socket Services, the Card and Socket Services Resource Manager must include the port address memory region. As well, you must ensure that the memory region is excluded for use by any memory managers, such as EMM386.EXE. Refer to your operating system documentation for further information on configuring your memory manager in CONFIG.SYS.

When you choose a port address be sure not to select any system-reserved I/O ports, otherwise you may encounter a resource conflict affecting the operation of your computer. Refer to “Configuring Specific Versions of Card and Socket Services” on page 47 for information on configuring some of the most popular versions of Card and Socket Services. Refer to your computer system's documentation for details on specific system information.

Interrupt Request Lines (IRQs)

The Sound Card requires exclusive use of two IRQs to support DOS games. The required IRQ can be:

- One of IRQ 5 or 7.
- One of IRQ 9, 10, 11, 12, 14 or 15

You select the first IRQ (IRQ 5 or 7) using the `Int` statement in the \MWD\MWAVE.INI file.

The selection of the second required IRQ (9, 10, 11, 12, 14 or 15) is typically controlled by Card and Socket Services. You will need to ensure that Card and Socket Services is properly configured to make the needed IRQ available.

If you are not using Card and Socket Services, the IRQ selection is controlled by command line options in the MWPCMS.EXE program. See "Operating Without Card and Socket Services" on page 49 for details.

DMA Channel

The DMA Channel can be either 0 or 1. You should always use DMA 1 unless your particular game will not work with DMA 1 or DMA 1 is being used by another component of your system.

Compatibility

The Compatibility option can be set from 0 (default) to 7. 0 or 1 should work for the majority of games to enable both music and sound effects. Refer to the README.DOS file for instructions specific to a wide range of games. If your game is not listed, try setting Compatibility to 0, 1, 2, or 4, in that order.

See "Games Compatibility" on page 36 for additional information.

Setting up DOS Games

The manufacturers of DOS games use a wide variety of techniques to give their games unique functions and performance. This diversity may cause problems for you. This section provides guidance for some of the most commonly encountered problems, such as insufficient memory. Typically, the best reference is the user manual for the specific game that is a problem. The game manufacturers usually provide extensive help and suggestions to overcome problems unique to their game.

The Audio Support Software enables the Sound Card to support most Sound Blaster- and Adlib-compatible DOS games. The following is a typical scenario you can follow to use the Sound Card with a game:

1. Install the game after the Sound Card's support software is loaded.
2. During the game's sound hardware setup, choose Sound Blaster 2.0 or compatible (or earlier Sound Blaster version) as your sound hardware for both FM music and sound effects. Typically you will be prompted to specify the IRQ, I/O Port and DMA Channel setting used by your sound card. For the Sound Card, the default settings are IRQ 7, I/O Port 220 and DMA Channel 1 (these settings are set in the \MWD\MWAVE.INI file).
3. Optimize CONFIG.SYS and AUTOEXEC.BAT for the game's memory requirements, if necessary. Check the game's user manual for memory requirement and setup procedure. Note that in order to make more memory available to the DOS game, the Sound Card can be used without Card and Socket Services. See "Operating Without Card and Socket Services" on page 49 for details.
4. Use the diagnostic program AAATEST.EXE to ensure the Sound Card is still functional after CONFIG.SYS and AUTOEXEC.BAT are changed. If you are using a clean boot disk to boot the system as suggested by many DOS games, the statements in the C:\AUTOEXEC.BAT file which load the Sound Card have to be added to the new AUTOEXEC.BAT file on the diskette in order to use the sound card. See "Creating a Clean Boot Disk" on page 40 for information on how to create a clean boot disk.
5. Follow the game's user manual to start and use game.

Games Compatibility

If your game hangs the system, you should try to use a different value in the "Compatibility" option in the [DOSGames] section of the \MWD\MWAVE.INI file. The Compatibility option affects the operation of the Audio Support Software in order to allow it to support a wide variety of games. Different games have different needs and the Compatibility option adjusts the software settings to meet those needs.

The "Compatibility" option can be set from 0 (the default) to 7. 0 or 1 should work for the majority of games to enable both music and sound effects. Refer to the README.DOS file to determine the best Compatibility setting for your particular game. If your game is not listed, try setting Compatibility to 0, 1, 2, or 4, in that order.

If the game still hangs the system, reboot the system, change the "Compatibility" option back to 0 and try running the game with sound hardware disabled.

Other Considerations

If your game hangs the system, the problem may be your memory manager settings. After you find a memory setting that works, enable the background music by choosing "Adlib Compatible" in the game's audio hardware setup. If the background music plays as expected, enable the sound effects by choosing "Sound Blaster Compatible" in the game's audio hardware setup. In general, avoid using any memory managers unless the game absolutely requires it.

Many games also require certain amounts of extra free memory, in addition to what is required for the game to load, to fully support the sound effects. Refer to your game's documentation for information on specific memory requirements.

Finally, if you are not able to make the game fully functional, try running the game in Windows DOS Box environment.

Adjusting the Volume

To adjust the volume while you are playing a game:

Increase Volume	Ctrl+Alt+U
Decrease Volume	Ctrl+Alt+D

Note: Certain games *trap* keyboard input while they are being played. For these games, volume control cannot be adjusted with this method. Refer to the game's documentation for information on adjusting the volume during play.

Optimizing Your Use of the Sound Card

This section provides you with information on how to:

- Free up memory in order to run DOS applications in DOS
- Use the appropriate audio mode for your needs
- Use some of the hardware features of the Sound Card.

Freeing Up Memory for DOS Games

You may find after installing the Sound Card that your computer does not have sufficient memory to run your applications. Many applications that use sound cards require maximum use of your computer's resources, particularly memory. Some applications, for instance, require 500 to 600 kilobytes (K) of memory below the DOS 640K boundary. Some applications also require *expanded (EMS)* or *extended (XMS)* memory in addition to their need for most of the memory below 640K.

And finally, some games use the memory region above 1 MB, through the use of DOS extenders, in order to store audio data. The Sound Card does not support some of these games. Refer to the README.DOS and README.TXT files for a complete listing of supported games in each mode (native DOS and the Windows DOS box).

The following section describes a number of things you can do to increase the amount of memory available to run these applications.

Before You Proceed: Many of the options to increase memory require that you modify your CONFIG.SYS and AUTOEXEC.BAT files. Before you proceed you should do the following:

- *At a minimum*, back up your CONFIG.SYS and AUTOEXEC.BAT files using other names (CONFIG.AUD and AUTOEXEC.AUD, for example). If you encounter problems with your modified configuration, you can then restore your original files and return your computer to the configuration you had prior to modifying your system files.
- Create a bootable (system) diskette with your current CONFIG.SYS and AUTOEXEC.BAT files. This ensures that you can reboot your computer if you encounter problems with the modified files. To create this disk, format a diskette with the /S parameter:

```
FORMAT A: /S
```

This transfers your system files to the diskette. Also copy your AUTOEXEC.BAT and CONFIG.SYS files over to the diskette. Ensure that the diskette you are formatting does not contain data that you need. Formatting wipes out all data on a diskette.

Don't Load Unnecessary Programs or Drivers:

A simple way to increase memory is to avoid loading terminate-and-stay-resident (TSR) programs and device drivers you don't require when you wish to run audio applications. To stop these programs and drivers from being loaded when you start up your computer, comment out the statements that load them in your CONFIG.SYS or AUTOEXEC.BAT files. If you are unsure about which programs and drivers are required or optional, refer to your computer and operating system documentation before you comment out any statements. Commenting out the wrong statement may cause problems with the operation of your computer.

Make More Memory Available to Games: Many DOS games require lots of DOS memory, and some even require you to start your PC from a clean boot disk. See "Creating a Clean Boot Disk" on page 40 for instructions on how to do this. Also consult your game's user manual for special instructions.

Some games will give you a message, "not enough memory", when you attempt to start the game, but others just lock up the computer if you don't have enough memory. Here are some suggestions to get the maximum available memory:

- Use the DOS command: `MEM /C /P` to determine how much free memory is available.
- If you are using IBM DOS 6.1, use the RAMBoost or RAMSETUP feature to move memory resident programs into upper memory and free up more lower memory. If you are using MS DOS 6.0 or MS DOS 6.2, use the MEMMAKER program. See your operating system documentation.
- If you are using MS DOS 5.0, use EMM386 and HIMEM to load any necessary device drivers into high memory. Consult your operating system documentation for information on how to do this.
- Create a "clean boot" disk, (using the directions below) and start your computer with this disk before starting the game.
- The manufacturers of DOS games that require unusually large amounts of memory realize that they have a potential usability problem, and as a result they usually provide extensive help and suggestions in the game's user manual. If you are not successful with the suggestions given here, the best reference is the user manual for the specific game that is a problem. Refer to their directions for creating more free memory, usually in the technical supplement or trouble shooting section.

Below are the contents of a typical CONFIG.SYS and AUTOEXEC.BAT for DOS games that require Extended Memory (XMS). Note that in this example, the Sound Card is enabled directly by the sound card's support software, without using the Card and Socket Services.

Sample CONFIG.SYS File

```
DEVICE=C:\DOS\HIMEM.SYS
DEVICE=C:\DOS\EMM386.EXE NOEMS X=C800-CB00
DOS=HIGH,UMB
FILES=30
BUFFERS=10
STACKS=9,256
```

Sample AUTOEXEC.BAT File

```
REM AUTOEXEC.BAT
REM
PROMPT $P$G
PATH=C:\DOS;C:\WINDOWS;C:\MWW\DLL;C:\MWD\MANAGER
LOADHIGH C:\MWD\MANAGER\MWPCMS.EXE /R=C800,9
SET MWROOT=C:\MWD
SET MWPATH=C:\MWD\MANAGER;C:\MWD\MWGAMES
LOADHIGH C:\MWD\MANAGER\MWDGAME.EXE
```

In order to provide Expanded Memory (EMS) for the games that need it, change the EMM386 statement in the above CONFIG.SYS to read as follows:

```
DEVICE=C:\DOS\EMM386.EXE RAM 1024 X=C800-CB00
```

where `1024` is the number of bytes of EMS to be made available to the game.

Note that these are just examples that may work in certain systems. Refer to your computer system's documentation for system configuration and resource allocation information.

Creating a Clean Boot Disk: To create a clean boot disk, do the following:

1. Put a new disk in the A: drive. At the DOS prompt, type:

   ```
   FORMAT A: /S
   ```

2. Create a CONFIG.SYS file on the diskette similar to this (assuming that Windows is installed in the C:\WINDOWS directory and DOS is installed in the C:\DOS directory):

   ```
   DEVICE=C:\DOS\HIMEM.SYS
   DEVICE=C:\DOS\EMM386.EXE NOEMS X=C800-CB00
   DOS=HIGH,UMB
   FILES=20
   BUFFERS=15
   STACKS=9,256
   ```

   If your game requires expanded memory, remove `NOEMS` from the second line of the above CONFIG.SYS sample and replace it with `nnnn RAM`, where `nnnn` is the amount of expanded memory required by the game (see the game's user guide).

   To make the best use of high memory, any `DEVICE=...` statement that you add to the CONFIG.SYS sample should be changed to `DEVICEHIGH=....` (Do not do this to the `DEVICE=C:\DOS\HIMEM.SYS` or `DEVICE=C:\DOS\EMM386.EXE NOEMS` statements).

3. Create an AUTOEXEC.BAT file on the diskette similar to this (assuming that Windows is installed in the C:\WINDOWS directory and DOS is installed in the C:\DOS directory):

```
@ECHO OFF
PROMPT $p$g
PATH=C:\WINDOWS;C:\DOS;
LOADHIGH C:\DOS\MOUSE.COM
SET MWPATH=C:\MWD\MWDGAMES;C:\MWD\MANAGER
SET MWROOT=C:\MWD
LOADHIGH C:\MWD\MANAGER\MWPCMS.EXE /R=C800,9
LOADHIGH C:\MWD\MANAGER\MWDGAME.EXE
```

   Many games require a mouse, so there is a statement to load your mouse driver into high memory in this example (`LOADHIGH C:\DOS\MOUSE.COM`). If your game does not use a mouse you may remove this statement.

   Do not include programs like SMARTDRV.EXE in your AUTOEXEC.BAT file.

4. Start your computer with the clean boot disk in the A: drive.

5. Start the game as directed in the game's user manual.

Use a Memory Manager: To make use of the memory above the 640K boundary in DOS you can use a memory manager, like EMM386.EXE. When this program is loaded, you may be able to load programs and device drivers in high memory, thus freeing up memory below the 640K boundary for your applications.

Note that Card Services and Socket Services, the software that controls the allocation of computer resources to PC Cards, require that certain memory areas be *excluded* from use by EMM386.EXE.

If you decide to point-enable the Sound Card, (that is, use direct memory access rather than having Card and Socket Services handle your computer resources), the Sound Card requires that you exclude a 12K memory region from use by your memory manager, if you use one. To exclude the region from C800 to CB00 for example, you would modify your EMM386.EXE statement to include the following information:

```
DEVICE=drive:\pathname\EMM386.EXE X=C800-CB00
```

In addition, you will need to specify the `/R` switch on the `C:\MWD\MANAGER\MWPCMS.EXE` statement in your AUTOEXEC.BAT file to identify the memory region and IRQ for the Sound Card to use, like so:

```
LOADHIGH C:\MWD\MANAGER\MWPCMS.EXE /R=C800,9
```

See "Operating Without Card and Socket Services" on page 49 for additional information.

To use Card and Socket Services, you may also need to exclude additional memory from use. Refer to your computer documentation, operating system documentation, or Card and Socket Services information to determine what memory region needs to be excluded for Card and Socket Services.

Here is an example of a CONFIG.SYS file where high memory has been made available. Note that this is an example only. Do not attempt to use this example as a replacement for your CONFIG.SYS file:

```
DEVICE=C:\DOS\HIMEM.SYS
DOS=HIGH,UMB
DEVICE=C:\DOS\EMM386.EXE X=C800-CB00 NOEMS
FILES=30
BUFFERS=30
LASTDRIVE=Z
STACKS=0,0
```

Following is an explanation of how this CONFIG.SYS works:

1. `DEVICE=HIMEM.SYS` provides XMS extended memory and allows DOS to be loaded high (between 1 MB and 1 MB + 64K). HIMEM.SYS is also required by EMM386.

2. `DOS=HIGH,UMB` tells DOS to load part of itself in the high memory area made available by HIMEM.SYS, and to link upper memory blocks (UMB) into its memory management scheme. UMB's are pieces of address space between 640K and 1 MB that can be used for loading device drivers and other programs. This will make the maximum possible amount of conventional memory (below 640K) available for your applications.

3. EMM386.EXE provides the UMB's discussed above. If `NOEMS` is specified, no expanded memory is made available to the application. If you require expanded memory, change this line to read `nnnn RAM` instead of

`NOEMS`, where nnnn is the number of kilobytes of EMS memory required by the application. For example, to provide 400K of expanded memory, change this line to read:

```
DEVICE=C:\DOS\EMM386.EXE 400 RAM X=C800-CB00
```

The availability of UMB's in a given computer depends on the design of the machine and the presence of cards and adapters in the computer that may have ROM addresses in the area between 640K and 1 MB. Note that not all computers have enough contiguous UMB's available to ensure that all applications will have enough memory to run.

Use the DOS `MEM` command with the `/c` or `/d` options to determine the availability and location of upper memory on your machine. Sometimes there are UMB's available that EMM386 doesn't know about. You can tell EMM386 to include them with the `I=` command line option. Refer to your operating system documentation for detailed information on EMM386.EXE.

About Card and Socket Services

This section provides you with some basic information on interrupt request lines (IRQs), I/O port addresses, and specific information on operating your Sound Card under Card and Socket Services.

The Sound Card requires exclusive use of certain high memory areas, I/O ports and system interrupt request lines (IRQs) to function properly. These system resources are usually assigned automatically by PCMCIA Card and Socket Services software. This software is typically provided by your computer system vendor and is specific to each computer model. Refer to the documentation included with your system for information on how to configure the Card and Socket Services installed in your computer.

Card and Socket Services are usually implemented as multiple device drivers that are loaded during system boot-up time by CONFIG.SYS. These Card and Socket Services drivers consume as much as 50K of conventional or high memory area (the first megabyte of memory that is accessible to DOS).

In order to conserve as much DOS memory as possible to accommodate the DOS games that require a large amount of free conventional and high memory, the Audio Support Software is designed to be able to access certain PCMCIA controllers directly, bypassing Card and Socket Services (this is known as *point-enabling* the card). Typically, 40K to 50K of DOS memory can be saved by not loading Card and Socket Services. See "Operating Without Card and Socket Services" on page 49 for details.

Interrupt Request Lines (IRQs)

An IRQ is a computer interrupt, used by the Sound Card to notify your computer's CPU that an event has occurred that requires attention. IRQs are not shareable under DOS, and PC Cards or adapters and ports operating concurrently must use unique IRQs. For instance, if you are using the Sound Card and an internal modem in the same computing session, they must not use the same IRQ. Requesting the same IRQ for two different cards or devices leads to system conflicts and unpredictable results. Card and Socket Services typically handles the allocating of IRQs to PC Cards, such as the Sound Card. You should only need to worry about IRQs if you decide to *point-enable* the Sound Card (operate it without the benefit of Card and Socket Services). See "Operating Without Card and Socket Services" on page 49 for specific information.

Note that IRQ conflicts may not generate error messages. You may find that some of your devices simply do not work when a conflict occurs. Devices that use IRQs include: serial and parallel ports, COM ports, modems, and PC Cards. You may find it helpful to keep a list of which devices use which IRQs and I/O port addresses. Some software (communications software for modems, for instance) requires this information in order to function properly.

I/O Port Addresses

I/O port addresses are pieces of memory used by I/O devices, of which the Sound Card is one. Some Card and Socket Services software requires that you reserve the particular addresses that each card or adapter uses in order to avoid conflicts. This is typically achieved using Card Services.

Card and Socket Services

Card and Socket Services provide a software interface between your computer and your various PC Cards. Socket Services operates at the lowest level, managing the PCMCIA socket(s) on your computer, reporting on socket status, card status, and providing a means for data to be transferred to and from the card from system memory.

Card Services operates at a higher level, providing the interface between software applications and Socket Services. Card Services allows PCMCIA-aware device drivers, configuration utilities, and programs to share PC Cards, sockets, and system resources simultaneously.

Some PC Cards cannot operate without having Card and Socket Services present and running. Other cards may work, but without the features that Card and Socket Services support, like *hot plugging* (the ability to insert cards while your computer is running and have the configuration automatically updated in order to recognize and use the card), the ability to run with more than one PC Card inserted at a time, and so on.

High Memory Allocation

Card and Socket Services requires exclusive use of certain portions of the high memory area (typically from address C000 to E000) in 4K (100 in hexadecimal) blocks. This high memory is required for Card and Socket Services to operate, and is also required for use by any PC Cards (including the Sound Card) loaded in the system.

The Sound Card requires one 4K and one 8K block of high memory to function. This memory is requested from Card and Socket Services.

You may need to make more high memory available to the Card and Socket Services in order for the 12K of high memory required by the Sound Card to be made available. See "Configuring Specific Versions of Card and Socket Services" on page 47 for information on how to configure the four most popular Card and Socket Services to achieve this). In addition, because of the wide variations of computer system design and the large number of Card and Socket Services vendors and versions, you should ALWAYS consult your computer system documentation or the system manufacturer before performing any changes described in this document. The information presented in this document is based on test results from testing done on specific computer models and specific versions of Card and Socket Services.

Note that changes in Card and Socket Services memory allocation may require corresponding changes in the EMM386 statement in your CONFIG.SYS file. The Expanded Memory Manager (EMM386.EXE) needs to be informed which high memory area is to be reserved for Card and Socket Services' use. For example, if high memory region C800 to CFFF is allocated for Card and Socket Services, you will need to exclude the corresponding region as follows:

```
DEVICE=C:\DOS\EMM386.EXE NOEMS X=C800-CFFF
```

This modification to CONFIG.SYS may sometimes be performed by the utility programs (often call "Resource Manager") included with the Card and Socket Services. Again, refer to your Card and Socket Services documentation for specific details.

When you assign high memory for Card and Socket Services, make sure that the memory region is not reserved by the computer manufacturer for specific system usage (for example, the block of memory from C000 to C7FF is reserved as a video buffer in some systems). Refer to your system's documentation for details.

Configuring Specific Versions of Card and Socket Services

The Sound Card is designed to work with version 2.0- or 2.1-compliant PCMCIA Card and Socket Services. The card was tested with the following four most popular versions of Card and Socket Services:

- IBM Card and Socket Services EZPLAY version 2.0 or higher
- Phoenix Card and Socket Services Card Manager 3.0 or higher
- SystemSoft Card and Socket Services Cardsoft version 2.1 or higher
- Award Card and Socket Services Cardware 2.0 or higher

In the following sections, the typical configuration procedure for each of these four Card and Socket Services is described. Please also always refer to your system's documentation for system-specific details.

For the information included in the following sections, it is assumed that the high memory region C800-CFFF is being allocated to the Card and Socket Services. Your version of Card and Socket Services may require a different memory region. Refer to your documentation for information specific to your software.

In general, if EMM386.EXE is loaded, the corresponding memory region should be excluded as follows, for example:

```
DEVICE=C:\DOS\EMM386.EXE NOEMS X=C800-CFFF
```

IBM EZPLAY

The Sound Card does not require any special configuration with EZPLAY Card and Socket Services.

Phoenix CardManager (PCM)

You may need to manually include the memory regions to be used by Phoenix CardManager (PCM). To do this, run the utility program PCMRMAN.EXE (usually supplied by the system vendor) to change the resource allocation. Make sure all the memory regions being used by Card and Socket Services are INCLUDED. Similarly, I/O Ports 388-38F and 200-26F, and the IRQ to be used with the card may also need to be included. Note that not all versions of PCM have the resource utility, PCMRMAN.EXE.

SystemSoft CardSoft

CardSoft needs some user configuration in most systems. If the Sound Card does not work with a specified setup, use the CONFIG.EXE utility to modify the CSALLOC.INI initialization file. This resource manager utility may not be shipped with all systems that use CardSoft.

A typical CSALLOC.INI file might look like:

```
#-----------------------------------------------
#
IO=108-1FF, 270-387, 390-3B7, 3E8-3FF
IRQ=3,5,A-B,F
#
# You will need to insert the following manually
# (using CONFIG.EXE):
#
MEMINCLUDE=C800-CFFF
IOINCLUDE = 200-26F,388-38F
IRQINCLUDE = 9
MEMEXCLUDE=C000-C7FF,D000-DFFF,E000-EFFF
#------------------------------------------------
```

You might need to adjust this configuration depending on your version of CardSoft and your hardware configuration.

Award Cardware

You will need to edit the CARDWARE.INI initialization file to use the Sound Card. All memory regions, I/O Port ranges and IRQs required by the Sound Card need to be manually included. Here is an example of CARDWARE.INI that includes the changes required to use the Sound Card:

```
:
[Resources]
MEM=0xC8000,0x1000,E  ; The first 4K of memory
MEM=0xC9000,0x6000,E  ; are used by Cardware
I/O=0x140,0x20,E,10   ; internally
I/O=0x200,0x40,E,10
I/O=0x330,0x10,E,10
I/O=0x380,0x10,E,10
IRQ=3,E
IRQ=4,E
IRQ=9,E
XIRQ=12,E
XIRQ=13,E
XIRQ=14,E
XIRQ=15,E
:
```

You might need to adjust this configuration depending on your version of Cardware and your hardware configuration.

Operating Without Card and Socket Services

While we do not recommend that you operate your computer without Card and Socket Services, the Sound Card will work (on Intel or Intel-compatible PCMCIA controller machines only) without them. You can comment out the device statements that load Card and Socket Services in order to reduce your memory use to a minimum. You may be able to save up to 50K of conventional memory not using Card and Socket Services.

You should first refer to your computer or operating system documentation for information on any problems that might arise if you choose not to use Card and Socket Services. Also note that certain PC Cards will not work without Card and Socket Services. If you will be using other cards on a regular basis in your PCMCIA socket, you will probably not want to comment out these statements.

If you choose to operate without Card and Socket Services, the following restrictions apply:

- The computer must have an Intel or compatible PCMCIA controller.
- Any adapters or PC Cards other than the Sound Card in your machine's PCMCIA socket(s) will not be functional until the system is rebooted with Card and Socket Services reloaded.
- The Sound Card is inserted into the system PCMCIA socket before you turn your computer on (hot-plugging is not supported without Card and Socket Services).
- You cannot use more than one card (the Sound Card in this case) concurrently. Multiple PC Card support is not available without Card Services.

MWPCMS.EXE

If you decide to operate without Card and Socket Services, and point-enable the Sound Card, an IRQ and memory window for the card to use need to be defined. This is done with the MWPCMS.EXE program and is handled automatically if you point-enable the Sound Card during the installation process.

To define or change the IRQ and memory address for the Sound Card to use, you use a switch on the MWPCMS statement in your AUTOEXEC.BAT file like so:

```
LOADHIGH C:\MWD\MANAGER\MWPCMS.EXE /R=C800,9
```

Where `C800` is the base memory address you intend to use for the Sound Card and 9 is the IRQ. The base memory address you use must be excluded from use by EMM386.EXE (see "Use a Memory Manager" on page 41 for an example) and must provide a contiguous 12K memory window for the Sound Card to use.

The IRQ you use must be 9, 11, 12, 14, or 15, and must not be used by any other device in your computer. IRQs are not shareable and if two devices attempt to use the same IRQ your computer may not function properly.

Some computers have PCMCIA controllers which can directly be accessed by different programmable I/O ports. These I/O ports can be specified usually by some BIOS configuration program. To provide direct access to these types of PCMCIA controllers (without Card and Socket Services), you can identify the controller address to the MWPCMS.EXE program using the `/I` option. By default, `/I=0` maps to I/O port 03E0h of the system. The possible values for this option are `0` through `F` (which map to I/O ports 03E0h to F3E0h). This option should be added to the end of the MWPCMS.EXE statement in the AUTOEXEC.BAT file, like so:

```
LOADHIGH C:\MWD\MANAGER\MWPCMS.EXE /R=C800,9 /I=0
```

This option will not be necessary for most systems. If it is necessary for your system, make sure it matches with the corresponding I/O port for your system's PCMCIA controller.

Help and Service Information

During the warranty period, you can get toll-free technical support 24 hours a day, 7 days a week, to answer any questions about your new IBM option. If you need warranty service, return or exchange is available. In addition, if your IBM option is installed in an IBM computer, you might be entitled to service at your location. Your technical support representative can help you determine the best alternative.

Before calling, please prepare for your call by following these steps.

CAUTION: To avoid electrical shock, unplug your computer and all attached devices from electrical outlets before performing any troubleshooting procedure.

Step 1: Troubleshooting

You might be able to solve the problem yourself. Before calling IBM, you might want to try some or all of the following troubleshooting procedures.

1. Remove and reattach all option cables.
2. Remove and reseat the option.
3. Place the option in a different slot, if one is available.
4. If your option contains jumpers or switches, check that they are set as specified.
5. Reread any software instructions; be sure software settings are correct.
6. Inspect the option for damage, such as bent pins.
7. Check the computer manual for instructions about the installation of upgrades. Look for a section about system setup or system configuration. Follow all procedures.
8. After completing these steps, reassemble the computer and connect the power cord.

Step 2: Preparing for the Call

To assist the technical support representative, have available as much of the following information as possible:

1. Option name, description, and serial number (if any)
2. Proof of purchase
3. Computer manufacturer, model, serial number (if IBM), and manual
4. Exact wording of the error message (if any)
5. Description of the problem
6. Hardware and software configuration information for your system

If possible, be at your computer. Your technical support representative might want to walk you through the problem during the call.

Step 3: Placing the Call to IBM

Use one of the following numbers:

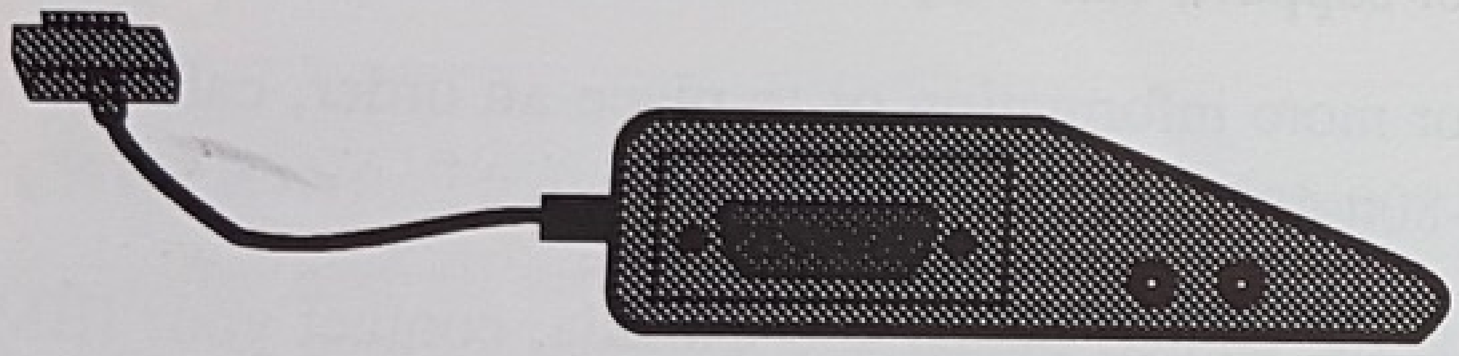
- Within the United States, call the Options by IBM HelpCenter* at 1-800-426-7299.
- Within Canada
  - For support, call HelpPC at 1-800-565-3344.
  - For more information or to place an order, call 1-800-465-7999.
- Outside the United States and Canada, contact your IBM HelpWare* number, your place of purchase, or your local branch office.

---

* *Trademark of the IBM Corporation.*

Appendix A. The Audio Attachment Module

The Audio Attachment Module (AAM) is an optional product (Part Number 08H3842), which provides a built-in 3.5-mm stereo input jack, a built-in 3.5-mm headphone jack, a built-in mono microphone, and a 15-pin MIDI/game port for connection to a standard joystick or musical instrument digital interface (MIDI) cable using an appropriate adapter. The AAM replaces the line-in/line-out cable that came with your Sound Card.



The Audio Attachment Module can support two joysticks operating simultaneously with the appropriate dual joystick cabling. This cable is available from a number of manufacturers. Contact your local computer store for further information.

Attaching the AAM

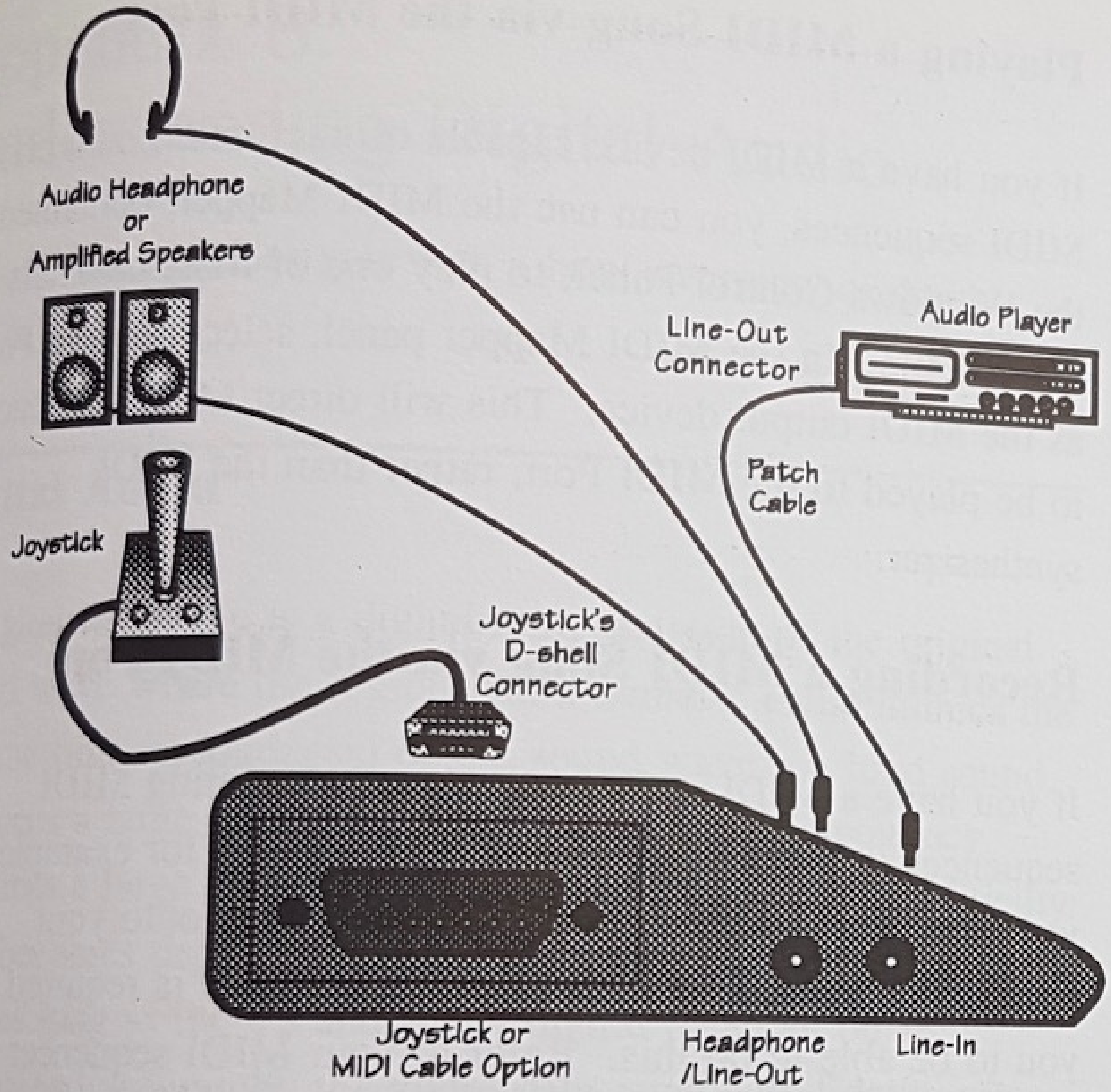
The instructions in this section explain how to connect the Sound Card to external audio and game hardware such as:

- Headphones or earphones
- Amplified speakers
- Amplifier with speakers
- Audio equipment (for example, tape deck, compact disc player, or others)

Caution

Turn power off to all external hardware before connecting their cables to the Sound Card. Please exercise care when connecting input and output cables to the Sound Card.

1. Review the connection of the external audio equipment to the line-in/line-out cable as shown in the following figure.



2. Connect your audio equipment (for example, tape deck, compact disc player, or others) to the Audio Attachment Module's *microphone/line-in* connector using a stereo audio patch cable.

3. Connect either a headphone cable, an audio amplifier, or amplified speakers to the Audio Attachment Module's *headphone/line-out* connector using a stereo audio patch cable.

4. To use MIDI, you must connect a MIDI-compliant device, such as a keyboard or synthesizer to the MIDI/game port of the Audio Attachment Module via a MIDI cable/game port adapter.

5. To use a joystick you must connect the joystick to the MIDI/game port of the Audio Attachment Module.

Game Port Address

While the Sound Card supports I/O port addresses at 220-22F, 240-24F, and 260-26F, if you wish to use a joystick with your games you must use the 220-22F memory address region. Note also that this setting requires that the memory region from 200-220 be free, as the joystick uses this memory region. Choosing one of the other two regions will still allow sound to play, but your joystick will not be enabled.

MIDI Port Option

If you connect your Sound Card to a MIDI music keyboard, you can use any of the popular Windows MIDI sequencer programs to play live music or to record the MIDI commands into a file.

The MIDI port provides a MIDI connection via the 15-pin D-shell connector on the Audio Attachment Module. You will need a separate MIDI Option Cable in order to connect the Audio Attachment Module to an external MIDI device. Refer to the documentation that came with your MIDI cable to ensure proper connection.

Playing a MIDI Song via the MIDI Port

If you have a MIDI device capable of interpreting and playing MIDI sequences, you can use the MIDI Mapper, contained in the Windows Control Panel, to play one or more channels of a MIDI file. In the MIDI Mapper panel, select Mwave Port as the MIDI output device. This will direct MIDI sequences to be played to the MIDI Port, rather than the MIDI synthesizer.

Recording a MIDI Song via the MIDI Port

If you have a MIDI device capable of generating MIDI sequences (a MIDI keyboard with MIDI Out, for example), you can record the MIDI sequences you play onto your computer. Separate MIDI sequencer software is required for you to be able to do this. Refer to your MIDI sequencer software documentation for details on how to record MIDI files.

Appendix B. Understanding Digital Audio

This section provides you with a brief overview of digital audio.

Digital Audio

A digital audio file is a digital representation of the original sound wave where the digital data's numeric value mimics the volume (that is, loudness) of the sound wave. A loud sound produces a large digital numeric value; a high frequency produces a large change in that numeric value. Audio fidelity then becomes dependent upon the accuracy of the digital data and, as long as the 0's and 1's of digital data can be reproduced accurately, the audio data retains its fidelity after many duplications.

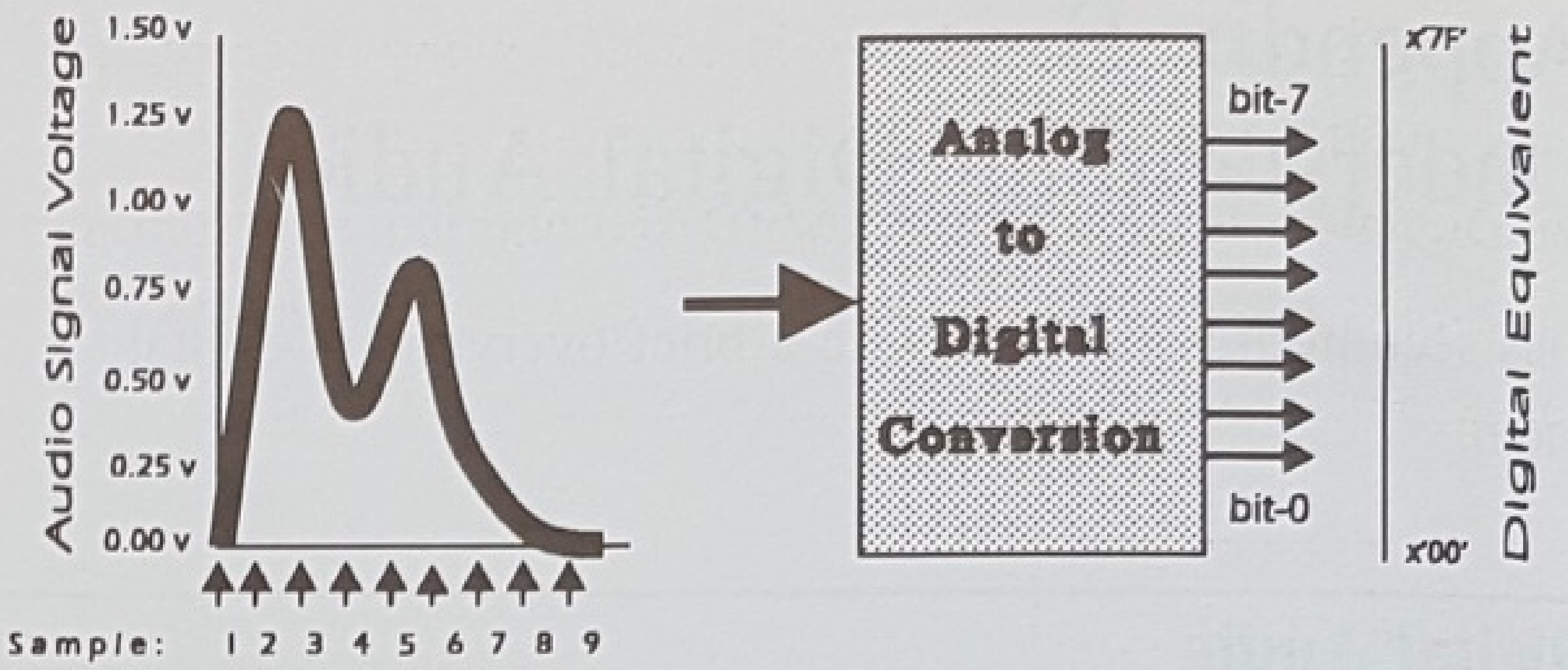
Analog-to-Digital conversion is performed by a technique called *sampling*[1]. Sampling theory states that an analog signal can be faithfully converted into digital if the frequency of the sampling is twice the highest analog frequency component.

To record the audio spectrum heard by the human ear, the upper frequency must be about 20,000 Hz (cycles per second). To retain this frequency response digitally, the *Nyquist* sampling rate of twice this, or 40,000 samples per second, is required. Frequencies above 20,000 Hz must be prevented from entering the digitization process as they may generate false *aliasing* audio signals. To prevent these unwanted frequencies, a low-pass filter (that is, a method to remove the high frequency content of the audio signal and *pass* the low frequency content) is incorporated. To account for physical limitations in this filter, a slightly higher sampling rate must be used. The audio compact disc, for example, uses a sampling rate of 44,100 samples per second to achieve its 20,000 Hz upper frequency limit.

---

[1] *Early sampling research was published by H. Nyquist in Certain Topics in Telegraph Transmission Theory, Transactions AIEE (April 1928), and by C. E. Shannon in A Mathematical Theory of Communications, Bell Systems Technical Journal 27 (1948). For a modern reference on audio sampling theory, consider K. C. Pohlmann, Principal of Digital Audio, Howard W. Sams and Company (1989).*

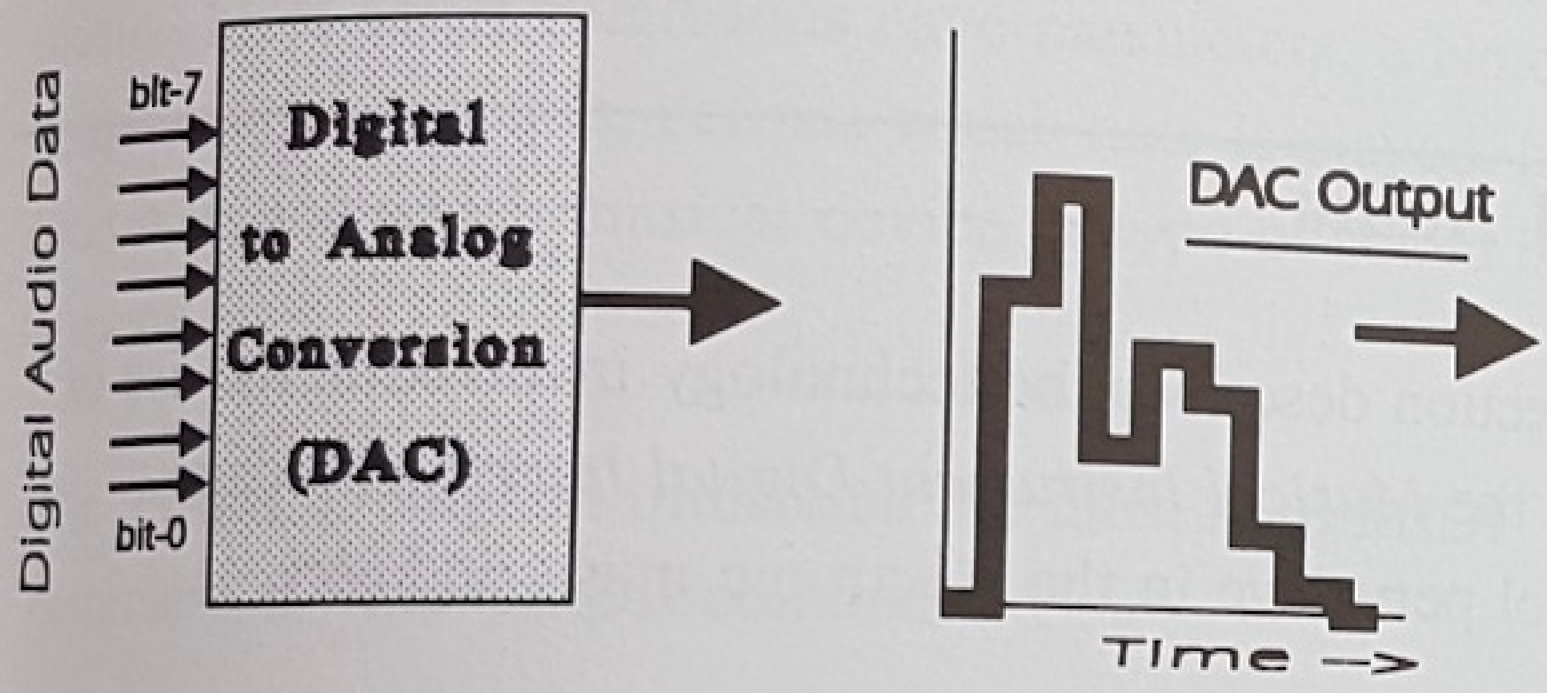
Audio Input: The following diagram illustrates the sampling process. Each sample produces a number representing the amplitude of the audio signal at a given point in time. An 8-bit sample (or *quantization*) divides a signal into 256 (that is, $2^{8\text{ bits}}$) different levels. By using more bits per sample, a more accurate representation of the original signal is obtained, and with less noise. The Sound Card, like the compact disc, can record each of its stereo channels at 44,100 samples per second with 16-bit quantization (that is, $2^{16\text{ bits}}$ = 65,536 different levels).

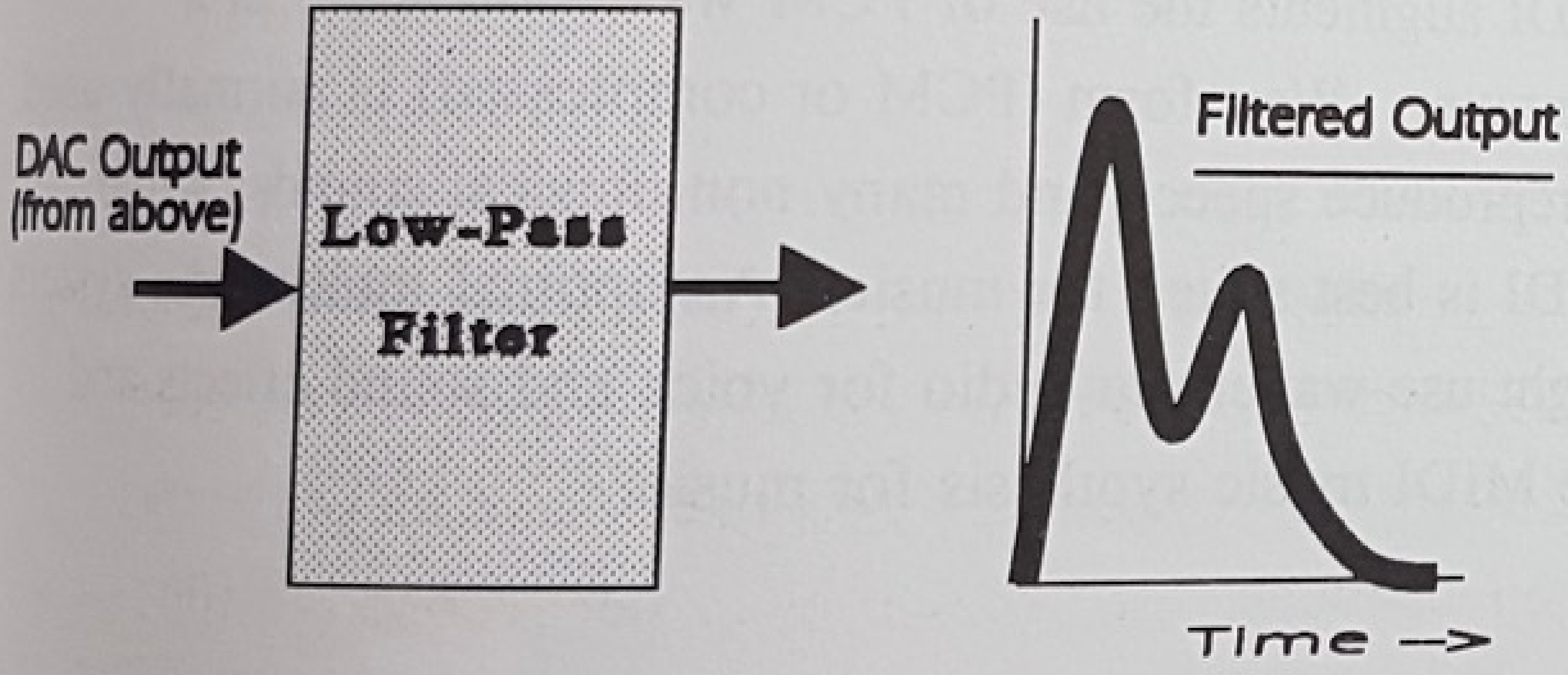


Sample Number	Analog Voltage	Digital Equivalent
1	0.00 v	x'00'
2	0.72 v	x'3C'
3	1.20 v	x'65'
4	0.41 v	x'22'
5	0.64 v	x'36'
etc.		

The analog signal's amplitude is measured every 22.7 microseconds (1/44,100 of a second), assigned to one of the 65,536 levels, and stored as a 2-byte value. Every second, 44,100 2-byte samples are generated for each of the two stereo channels. At 176,400 bytes per second (44,100 samples x 2 bytes x 2 channels), 10.5 megabytes (MB) of digital audio data are generated per minute.

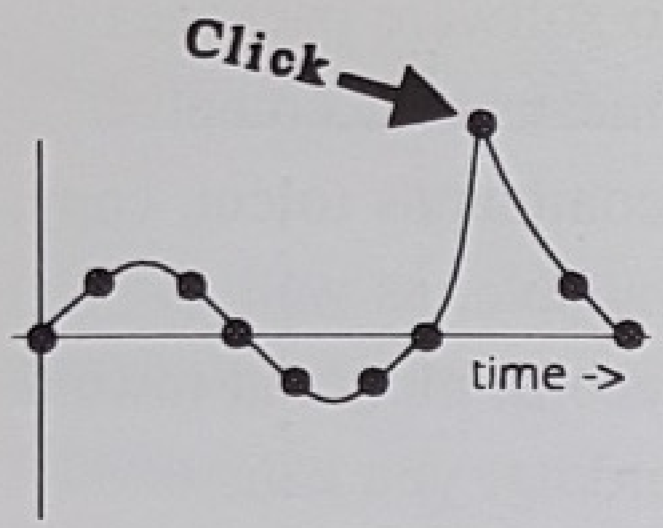
Audio Output: As shown in the following diagram, an analog voltage is generated from the digital audio sample by the Digital-to-Analog Convertor (DAC) and is passed through a low-pass filter to remove the unwanted high frequency component, thus producing a smooth analog waveform.



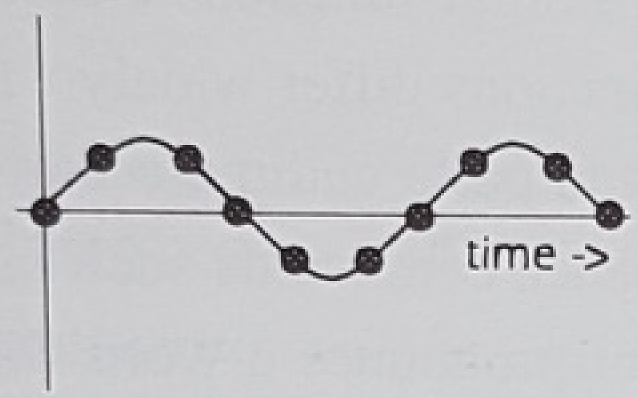


Editing Audio Files: Many audio software packages provide similar functions although the means to accomplish these functions differ widely. Editing commands to cut, copy, delete, and paste audio are normally available, as well as performance commands such as play, record, mix, and rewind. If you mispronounce a word while recording, you can rerecord the proper pronunciation later and overlay it on the original recording. If the speech is too long, several sections can be deleted. If there is an audio file of music and one of speech, the two could be mixed together to form one file.

Consider the removal of a short click in the background of an audio passage. You play the audio file until you hear a click. You can display the audio data at the click using a digital audio editing program and delete or modify the offending audio sample. The following diagram illustrates a visual representation of audio data before and after the click's removal.



Audio Waveform with "Click"



Audio Waveform with "Click" Removed by Waveform Editor

● = Actual Audio Sample

Waveform Audio

The Sound Card supports pulse code modulation (PCM), also called Linear PCM, which is the most common method of storing digital audio data. The Sound Card's 16-bit analog-to-digital and digital-to-analog converters produce high quality digital audio recording and playback in the following formats:

- Channels: Stereo and Mono
- Sample Width: 8-bit and 16-bit.
- Optimized Sample Rate: 11,025, 22,050, and 44,100 samples per second.

PCM is available in many audio applications, including the Windows Sound Recorder.

MIDI Audio

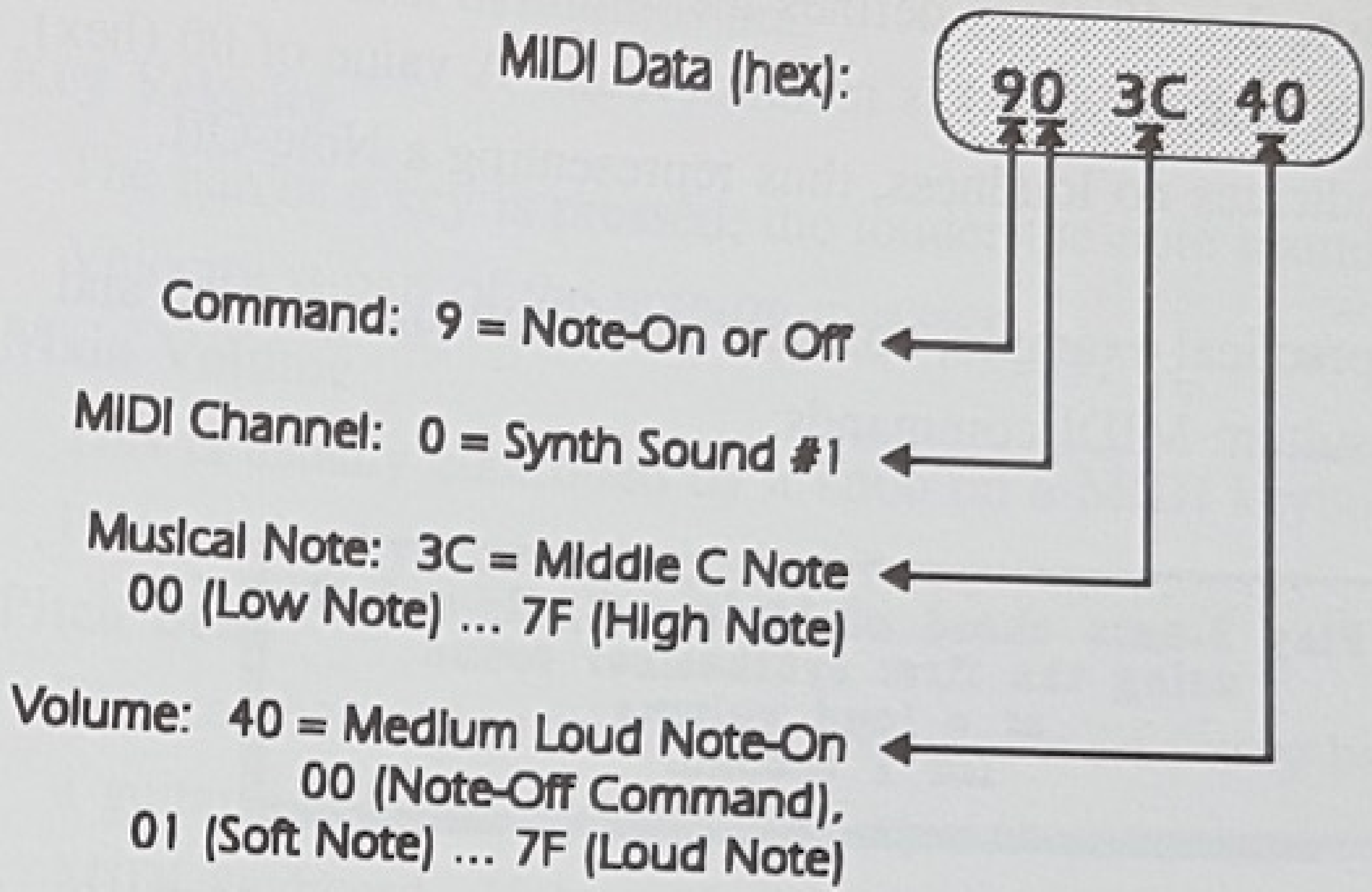
This section describes the technology involved in the use of MIDI, the *Musical Instrument Digital Interface*, a data protocol pervasive in the electronic music industry.

MIDI augments the use of PCM waveform audio in a computer. Waveform (PCM or compressed) is normally used to reproduce speech and many non-musical sounds, while MIDI is best suited for music. An optimal multimedia system might use waveform audio for voice and sound effects and use MIDI music synthesis for music.

A Definition of MIDI

MIDI data provides music capability with far less data storage requirements than sampled music. MIDI commands denote musical events such as a *Note-On* (the start of a note) or a *Note-Off* (the end of a note), not the actual sound of the music. Most MIDI commands have parameters; a Note-On command, for example, defines which note is played, how loud it is, and which musical device or type of sound is to respond.

The following diagram illustrates the most used MIDI command, a Note-On/Off command.


MIDI Data (hex):
90 3C 40
Command: 9 = Note-On or Off
MIDI Channel: 0 = Synth Sound #1
Musical Note: 3C = Middle C Note
00 (Low Note) ... 7F (High Note)
Volume: 40 = Medium Loud Note-On
00 (Note-Off Command),
01 (Soft Note) ... 7F (Loud Note)

- Byte 1 = 90 (hexadecimal) defines this data as either a Note-On or a Note-Off command and that the sound found on the synthesizer's MIDI channel 1 is to be used. This sound might be a piano or a horn and is determined by other MIDI commands. There are 16 MIDI channels in a basic MIDI system; therefore, up to 16 different sounds may be played.
- Byte 2 = 3C (hex) defines the musical note. In this case, 3C (hex) refers to Middle C on a piano keyboard.

- Byte 3 = 40 (hex) defines the loudness of the note. In this case, 40 (hex) is medium loud. A value of 00 (hex) indicates no loudness, thus representing a Note-Off.

As a practical example, consider the following situation and the resultant MIDI commands:

Play 3-note chord of Middle C, E, and G,
using the first synthesizer sound
at a loud volume
for 1 second.

Time	MIDI Data	MIDI Command
0.000	90 3C A0	Note-On, Sound #1, Middle C, Loud
0.001	90 40 A0	Note-On, Sound #1, Middle E, Loud
0.002	90 43 A0	Note-On, Sound #1, Middle G, Loud
:::		
:::		
1.000	90 3C 00	Note-Off, Sound #1, Middle C
1.001	90 40 00	Note-Off, Sound #1, Middle E
1.002	90 43 00	Note-Off, Sound #1, Middle G

Pressing the three MIDI keyboard keys generates three Note-On commands by the MIDI keyboard, one 3-byte command for each note. After 1 second, the musician releases the MIDI keyboard keys and three Note-Off commands are generated by the MIDI keyboard, again one 3-byte command for each note. With MIDI, this action required 18 bytes: three Note-On commands and three Note-Off commands, each three bytes long. To digitally record this chord with compact disc quality, a 1-second recording would require 176,000 bytes. Quite a difference!

In practice, about 12,000 bytes per minute are required to store a musical production in MIDI, but this number varies with the musical production. A fast piece of music with many musical instruments requires more notes and up to 20,000 bytes per minute or more might be required. A slow piece of music using a solo instrument would require fewer notes and under 4,000 bytes per minute might be adequate.

General MIDI

The Sound Card uses the General MIDI sound structure, the most common format in the industry. Most MIDI files sold for multimedia are in the General MIDI format.

MIDI Support

The Sound Card's MIDI device driver provides a 16-voice MIDI synthesizer that exceeds the Base Multitimbral requirements of the MPC 1 and MPC 2 specifications. The Audio Support Software provides a full set of General MIDI patches (instrument sounds) using sampled sounds provided by Prosonus**, a leader in music synthesis technology. These patches are created from actual recordings of real instruments to achieve the best possible sound fidelity. See "General MIDI Melodic Instrument Patches" on page 64 and "General MIDI Percussion Note Mapping (Channels 10 and 16)" on page 68 for listings of the specific instrumentation.

MIDI Controls

The MIDI synthesizer recognizes several types of control information in the MIDI data stream. This information is usually generated on a MIDI keyboard through the use of special buttons, joysticks, or thumb wheels.

The MIDI control definitions are:

Key Velocity

The harder a key is pressed, the louder the note sounds. Velocity is part of the note-on message.

Main Volume

This is usually controlled by a knob on a MIDI keyboard. It is received on control number 7.

Pitch Bend

This can be used to mimic the sound of a whammy bar on a guitar and is usually controlled by a thumb wheel on a MIDI keyboard. Note pitch can be varied +/- 2 semi-tones.

Pan

This varies the stereo left/right channel balance and is usually controlled by a thumb wheel on a MIDI keyboard. It is received on control number 10.

Vibrato

Also referred to as modulation, this control produces rapid, small changes in the pitch of a note and is usually controlled by a thumb wheel on a MIDI keyboard. Vibrato depth can be varied +/- 2 semi-tones. It is received on control number 1.

Sustain

Each note of an instrument has an envelope that describes the loudness of the note during attack, decay, sustain, and release periods. Some MIDI keyboards can be used with a piano-like sustain pedal that prolongs the sustain period to mimic holding a note. It is received on control number 64.

General MIDI Melodic Instrument Patches

1	Acoustic Grand Piano
2	Bright Acoustic Piano
3	Electric Grand Piano
4	Honky-tonk Piano
5	Rhodes Piano
6	Chorused Piano
7	Harpsichord
8	Clavinet
9	Celesta
10	Glockenspiel
11	Music Box
12	Vibraphone
13	Marimba
14	Xylophone
15	Tubular Bells
16	Dulcimer
17	Hammond Organ
18	Percussive Organ
19	Rock Organ
20	Church Organ
21	Reed Organ
22	Accordion
23	Harmonica
24	Tango Accordion
25	Acoustic Guitar (nylon)
26	Acoustic Guitar (steel)
27	Electric Guitar (jazz)
28	Electric Guitar (clean)
29	Electric Guitar (muted)
30	Overdriven Guitar
31	Distortion Guitar
32	Guitar harmonics
33	Acoustic Bass
34	Electric Bass (finger)
35	Electric Bass (pick)

36	Fretless Bass
37	Slap Bass 1
38	Slap Bass 2
39	Synth Bass 1
40	Synth Bass 2
41	Violin
42	Viola
43	Cello
44	Contrabass
45	Tremolo Strings
46	Pizzicato Strings
47	Orchestral Harp
48	Timpani
49	String Ensemble 1
50	String Ensemble 2
51	SynthStrings 1
52	SynthStrings 2
53	Choir Aahs
54	Voice Oohs
55	Synth Voice
56	Orchestra Hit
57	Trumpet
58	Trombone
59	Tuba
60	Muted Trumpet
61	French Horn
62	Brass Section
63	SynthBrass 1
64	SynthBrass 2
65	Soprano Sax
66	Alto Sax
67	Tenor Sax
68	Baritone Sax
69	Oboe
70	English Horn
71	Bassoon
72	Clarinet
73	Piccolo
74	Flute
75	Recorder
76	Pan Flute
77	Blown Bottle
78	Shakuhachi
79	Whistle

80	Ocarina
81	Lead 1 (square)
82	Lead 2 (sawtooth)
83	Lead 3 (calliope)
84	Lead 4 (chiff)
85	Lead 5 (charang)
86	Lead 6 (voice)
87	Lead 7 (fifths)
88	Lead 8 (bass + lead)
89	Pad 1 (new age)
90	Pad 2 (warm)
91	Pad 3 (polysynth)
92	Pad 4 (choir)
93	Pad 5 (bowed)
94	Pad 6 (metallic)
95	Pad 7 (halo)
96	Pad 8 (sweep)
97	FX 1 (rain)
98	FX 2 (soundtrack)
99	FX 3 (crystal)
100	FX 4 (atmosphere)
101	FX 5 (brightness)
102	FX 6 (goblins)
103	FX 7 (echoes)
104	FX 8 (sci-fi)
105	Sitar
106	Banjo
107	Shamisen
108	Koto
109	Kalimba
110	Bag pipe
111	Fiddle
112	Shanai
113	Tinkle Bell
114	Agogo
115	Steel Drums
116	Wood block
117	Taiko Drum
118	Melodic Tom
119	Synth Drum
120	Reverse Cymbal
121	Guitar Fret Noise
122	Breath Noise
123	Seashore

124 Bird Tweet
125 Telephone Ring
126 Helicopter
127 Applause
128 Gunshot

General MIDI Percussion Note Mapping (Channels 10 and 16)

35	Acoustic Bass Drum
36	Bass Drum 1
37	Side Stick
38	Acoustic Snare
39	Hand Clap
40	Electric Snare
41	Low Floor Tom
42	Closed Hi Hat
43	High Floor Tom
44	Pedal Hi-Hat
45	Low Tom
46	Open Hi-Hat
47	Low-MidTom
48	Hi Mid Tom
49	Crash Cymbal 1
50	High Tom
51	Ride Cymbal 1
52	Chinese Cymbal
53	Ride Bell
54	Tambourine
55	Splash Cymbal
56	Cowbell
57	Crash Cymbal 2
58	Vibraslap
59	Ride Cymbal 2
60	Hi Bongo
61	Low Bongo
62	Mute Hi Conga
63	Open Hi Conga
64	Low Conga
65	High Timbale
66	Low Timbale
67	High Agogo
68	Low Agogo
69	Cabasa
70	Maracas
71	Short Whistle
72	Long Whistle
73	Short Guiro
74	Long Guiro
75	Claves

76 Hi Wood Block
77 Low Wood Block
78 Mute Cuica
79 Open Cuica
80 Mute Triangle
81 Open Triangle

MIDI Synthesizer

The MIDI Synthesizer is an MCI** device driver that plays 8 voices simultaneously using sampled sound technology for the ultimate in synthesizer realism. MIDI songs can be played by the synthesizer using off-the-shelf Windows MCI software such as the Windows Media Player or MidiSoft Studio**. The synthesizer uses standard .WAV files at 22 KHz sampling rates. The full set of General MIDI instruments (patches) are shipped with the Sound Card. The General MIDI instruments are mapped to MIDI channels using the MIDI Mapper Control Panel that currently ships with Windows 3.1.

Appendix C. Testing and Problem Determination

This section tells you what to do if you run into problems using your Sound Card. If you are running into memory problems, you should first take a look at "Optimizing Your Use of the Sound Card" on page 37 for tips on how to free up additional memory.

Problem Determination

This section tells you how to use the DOS diagnostic program AAATEST.EXE, and also provides you with a description of some potential problems and their solutions.

Testing the Sound Card in DOS

AAATEST.EXE is a diagnostic program included in the default installation of the audio support software for DOS. Before testing your card using this program, ensure that both MWPCMS.EXE and MWDGAME.EXE have been loaded by your AUTOEXEC.BAT file. This diagnostic program can be used with or without Card and Socket Services loaded.

To test the Sound Card, first plug headphones or speakers into the Audio Attachment Module after you have installed the audio support software and rebooted your computer. Enter the following commands at the DOS prompt:

```
cd \MWD\MANAGER
AAATEST
```

AAATEST will show the hardware resources being used by the Sound Card. After detecting that the card is inserted and all device drivers are loaded in memory, the program will prompt you to press any key to start the FM music test which plays a series of five different notes. After the notes are played the WAV play test will start. You should hear a human voice introducing the Sound Card. Note that this test program will only work in the native DOS environment (not within a Windows DOS box session).

What AAATEST May Indicate: Here are some potential problems that AAATEST may identify and what you can do to fix them:

Cannot hear FM music test

Make sure I/O address 388-38F is available from Card and Socket Services and it is not being used by another device Also verify that I/O Window 1 in the Card Resource Information section of AAATEST is allocated to 388 with a size of 8 bytes.

Machine freezes in WAV test, bad or missing WAV, or message: Sound Card not found at 0x2X0H is displayed

Make sure the I/O address space, IRQ and DMA Channel in the MWAVE.INI file are correct and freely available to the Card and Socket Services. Also make sure that the I/O address space is not being used by another device like an internal sound card. Also verify that I/O Window 2 in the Card Resource Information section of AAATEST is allocated to 2X0H (X=0,4,6) with a size of 30 (hex) bytes if X=0 and size of 10 (hex) bytes if X=4 or 6.

Potential Problems and Solutions

Here are some problems you might encounter. If your problem is not listed here or if the suggested action does not solve your problem, and feel you need some additional help. Refer to “When All Else Fails” on page 76 for further information.

"Sharing violation" message during install

If you are using the DOS SHARE TSR (terminate and stay resident) program, disable it and then retry installing your software.

Not enough memory to run a game

Refer to “Optimizing Your Use of the Sound Card” on page 37 for information on optimizing DOS game setup. Also refer to the README file and your game documentation for game-specific tips.

Joystick doesn't work with a game

Make sure you choose I/O port 220H as the default port address in the game and in the MWAVE.INI file. See "Setting the Port Address, IRQ and DMA Channel" on page 32 for detailed information.

Cannot get sound effects to work properly in a game

Make sure that the I/O port and interrupt in the MWAVE.INI file (in DOS) or SYSTEM.INI file (in Windows) is consistent with the game setup.

Cannot get Sound Blaster sound effects to work at all

One of the following:

- Try Adlib compatibility.
- Try running the game under the Windows DOS box and normal DOS.
- May be a DOS extender problem, attempting to use the memory beyond 1 MB.
- Ensure that the I/O port addresses from 200 to 26F are available to Card and Socket Services. Refer to your Card and Socket Services documentation for further information.
- If you are operating on a Toshiba** computer, refer to the README file.

Card and Socket Services doesn't recognize the Sound Card

One of the following:

- The required I/O and memory resources for the Sound Card are not available from your version of Card and Socket Services. Run the Card and Socket Services Resource Manager to re-allocate these resources (refer to your Card and Socket Services documentation, as well as the README file).
- You might have an older version of Card and Socket Services. Refer to the README file for supported versions of Card and Socket Services.

The Sound Card doesn't work AND you are using a super client driver

Use the /S parameter on the MWPCMS statement in your AUTOEXEC.BAT file. This option allows the MWPCMS.EXE program to gain exclusive control back from any PCMCIA super client driver. Add it to the end of the MWPCMS.EXE statement in the AUTOEXEC.BAT file, like so:

```
LOADHIGH C:\MWD\MANAGER\MWPCMS.EXE /S
```

Point enabler doesn't work

One of the following:

- Use the switch `/R=C800,9` with the MWPCMS.EXE device driver.
- The address space you have specified is being used by another device driver or being mapped to device ROM (like a SCSI controller). Remap the Sound Card memory to a different address space, using the `/R=C800,9` switch.
- You don't have an Intel-compatible PCMCIA controller. Use Card and Socket Services.
- If you are using EMM386.EXE, make sure you are excluding the proper memory regions. See "Use a Memory Manager" on page 41 for additional information.

Hot plugging doesn't work

One of the following may be the problem:

- You are using a point enabler which doesn't support hot-plugging.
- Hot plugging is not supported when you are still playing a game. If possible, exit the game and the Sound Card will be re-enabled.

Hot plugging doesn't work in Windows

Make sure you have installed APM feature for Windows. If it is not installed, start Windows SETUP and, under **System Information**, change **Computer: MS-DOS System** to **MS-DOS System with APM** or **Intel 386SL Based System with APM**.

Audio performance is very slow, or video is "jumpy" (jerky)

This usually occurs if you are attempting to play more than two WAV or video files at the same time on a slow processor (a 386SX, for example). Use a disk caching program like SMARTDRV. If you are already using a disk caching program, try increasing the disk cache size.

There are gaps in WAV file recorded using the Sound Card

This problem is usually due to a high frequency of hard disk activity during recording in computers equipped with less advanced processors (386SX, for example). This problem can be reduced or eliminated by lowering the recording sampling rates, increasing the sound buffer size (selectable in Sound Setup in Control Panel), and increasing disk cache size using SMARTDRV.

Windows error message that no WAV device is available

This is usually because the DSP resources are consumed. Try stopping an application that uses the DSP and then retry your failing function.

There is a DSP PCMCIA Card Message at Windows startup, or a Card Configuration Error when trying to load MWDGAME in DOS

These error messages are displayed when the required hardware resources cannot be obtained from Card and Socket Services and/or these resources are being shared by another device or driver. There are three types of messages:

I/O Resource Failure

Make sure I/O port 240-247 is available to Card and Socket Services and not being used by any other device.

IRQ Resource Failure

Make sure that an IRQ is freely available to Card and Socket Services and not being used by another device.

Memory Resource Failure

Make sure that sufficient memory has been allocated to Card and Socket Services and it is excluded in the EMM386 statement of your CONFIG.SYS file. Exclude this memory area in the Windows SYSTEM.INI file as well.

Loud noise (squeal) from my speakers

This typically is caused by audio feedback coupling between the microphone and speakers. Try re-orienting your microphone, especially making sure it does not point directly toward the speakers.

Alternatively, make sure that the Auxiliary (AUX) path of the Sound Card is not ON. This causes a *feedback loop* to the recording source while you are recording. The squeal can be eliminated by either lowering the gain/volume in the

AUX output or by turning off the AUX path altogether. You can control the AUX output gain and activation using the Sound Card's Audio Control program.

DOOM, DOOM II or Raptor hangs at initialization screen.

Due to the specific hardware design of certain systems, the sound effects of these games are not fully supported. Sound effects for DOOM and DOOM2 have to be disabled, while the background music is still fully supported. Support for Raptor's sound effects is supported as Adlib-compatible only.

"0x34: Problem initializing the Manager" messages and/or Sound Fail/Music Fail are displayed when trying to load MWDGAME.EXE

This return code from MWDGAME.EXE indicates improper hardware initialization. If the PCMCIA Card and Socket Services are loaded, try removing the Sound Card from the PCMCIA slot, wait for about 5 seconds and then re-insert the Sound Card. If the PCMCIA Card and Socket Services is not loaded, reboot the system to allow the Sound Card to be reinitialized. If the problem is still not corrected, the problem might actually be caused by a system resource conflict or incompatible system. This is usually caused if the I/O port addresses specified in the MWAVE.INI file is not available from PCMCIA Card and Socket Services.

The game does not seem to get the EMS (Expanded memory) it requires although EMM386 is correctly set up in CONFIG.SYS.

Expanded memory simulation by EMM386 requires the use of a Page Frame memory of size 64K, typically located at D000 to DFFF in the High Memory region. As a result, you should make sure no other driver or device is using any of the D000 to DFFF region. Check the DOS user's manual for more information on EMM386.

Possible Causes of Problems

If you experience errors while using your Sound Card with its applications or with the verification program, refer to the following list of potential problems and also refer to the README file on installation diskette #1.

Here is a list of items which may be the cause of your problem:

- The audio cabling configuration is not correct for your application.
- The audio cabling is bad.
- The audio equipment is bad.
- The MIDI cabling configuration is not correct for your application.
- The MIDI cabling is bad.
- The MIDI equipment is bad.
- The computer is faulty.

When All Else Fails

If following the steps suggested in the list on page 70 has not helped you isolate your particular problem, you should call the customer help line. Before you place the call, make sure you have the following information available. You will be asked to provide some or all of this information, depending on the nature of the problem you describe.

Support Call Checklist: If you call for support, please have the following information readily available. It will aid in determining and eliminating your problem.

- 3D PCMCIA Sound Card identification (from label on back of Sound Card)
- PCMCIA Sound Card configuration
- Make and Model of computer
- Type of Processor
- Amount of system memory (RAM)
- Other cards in your system (and their configuration information if possible)
- Peripherals attached to your system
- DOS and Windows Versions
- Diagnostic error information if available
- List of Application software that was running when problem was encountered
- Scenario leading up to point of failure

Customer Support: Refer to the Warranty and Service Information contained in the 3D PCMCIA Sound Card package.

Industry Canada Compliance Statement

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the interference-causing equipment standard entitled: *Digital Apparatus*, ICES-003 of Industry Canada.

Avis de conformité aux normes d'Industrie Canada

Cet appareil numérique respecte les limites de bruits radioélectriques applicables aux appareils numériques de Classe B prescrites dans la norme sur le matériel brouiller : *Appareils numériques*, NMB-003 édictée par Industrie Canada.

IBM

Part Number: 08H3852

Printed in Italy

08H3852